CONNECTICUT RIVER FLOOD CONTROL PROJECT

HARTFORD, CONN.

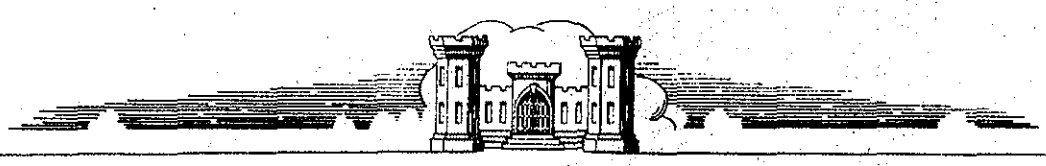
CONNECTICUT RIVER, CONNECTICUT

SPECIFICATIONS

FOR THE CONSTRUCTION OF

KEENEY LANE PUMPING STATION

ITEM Ht. 11 - CONTRACT



WAR DEPARTMENT, CORPS OF ENGINEERS, U. S. ARMY
U. S. ENGINEER OFFICE, PROVIDENCE, RHODE ISLAND

FEBRUARY 1947

CONNECTICUT RIVER FLOOD CONTROL PROJECT

SPECIFICATIONS

FOR

CONSTRUCTION

OF

KEENEY LANE

PUMPING STATION

HARTFORD, CONNECTICUT

12 FEBRUARY 1947

NEW ENGLAND DIVISION

CORPS OF ENGINEERS, WAR DEPARTMENT

BOSTON, MASSACHUSETTS

Bid No. _____ Bidder _____

(Do not write above this line)

Serial No. 19-016-47-23

I N V I T A T I O N F O R B I D S

(CONSTRUCTION CONTRACT)

NEW ENGLAND DIVISION
CORPS OF ENGINEERS, WAR DEPARTMENT
31 ST. JAMES AVENUE
BOSTON 16, MASS.

12 FEBRUARY 1947

Project: CONSTRUCTION OF KENNEY LANE PUMPING STATION, HARTFORD, CONNECTICUT.

1. Sealed bids, in duplicate, will be received until 2:00 P.M., Eastern Standard Time, 18 March 1947, and then publicly opened, for furnishing all plant, labor, materials and equipment, except materials or equipment specified herein to be furnished by the Government, and performing all work for the above-described project in strict accordance with the specifications, schedules, drawings and addenda.

2. Bids will be submitted in sealed envelopes upon the attached Government form of bid, marked in the upper left hand corner "Bid under Serial No. 19-016-47-23 to be opened 18 March 1947", the serial number indicating the project for which the bid is submitted. The bidder who is awarded the contract will be required to execute the War Department contract form for construction (W. D. Contract Form No. 2). This form is available at the office of the New England Division, Corps of Engineers, War Department, 31 St. James Avenue, Boston 16, Mass.

3. The right is reserved, as the interest of the Government may require, to reject any and all bids, to waive any informality in bids received, and to accept or reject any or all items of any bid, unless the bidder qualifies such bid by specific limitation.

4. Bid bond on U. S. Standard Form No. 24 in a penal sum of not less than twenty (20) per cent of the bid price will be required with each bid.

5. Bidders should carefully examine the drawings and specifications, visit the site of the work, and fully inform themselves as to all conditions and matters which can in any way affect the work or the cost thereof. Should a bidder find discrepancies in, or omissions from, the drawings, specifications or other documents, or should he be in doubt as to their meaning, he should at once notify the Contracting Officer and obtain clarification prior to submitting any bid.

6. Each bidder shall enclose with his bid a statement of whether he is now or ever has been engaged in any work similar to that covered by the specifications herein, the year in which such work was performed and the manner of its execution, and giving such other information as will tend to show the bidder's ability to prosecute the required work.

7. The bidder shall state in his bid that he has available or under his control plant of the character and in the amount required to complete the proposed work within the specified time. Each bidder shall furnish a list of the plant proposed for use on the work.

8. Drawings will be furnished bona fide bidders on request. A deposit of $15.00 per set will be required to insure their return. The deposit should be in the form of a United States money order or a certified check made payable to the "Disbursing Officer, New England Division, Corps of Engineers, War Department, Boston, Mass." The deposit, if made, will be refunded if the drawings are returned in good condition, transportation prepaid, to the issuing office within fifteen (15) days after the opening of bids.

9. Modifications prior to date set for opening bids. - The right is reserved, as the interest of the Government may require, to revise or amend the specifications and/or drawings prior to the date set for opening bids. Such revisions and amendments, if any, will be announced by an addendum or addenda to this Invitation for Bids. Copies of such addenda as may be issued will be furnished to all prospective bidders. If the revisions and amendments are of a nature which requires material changes in quantities or prices bid or both, the date set for opening bids may be postponed by such number of days as in the opinion of the Division Engineer will enable bidders to revise their bids. In such case, the addendum will include an announcement of the new date for opening bids.

STATEMENT OF WORK
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SW-2	Principal Features.....	2

Serial No. 19-016-47-23

SPECIFICATIONS

PART I

STATEMENT OF WORK

SW-1. DESCRIPTION OF WORK. - a. Work to be done. - The work consists of furnishing all plant, labor, materials and equipment, except materials or equipment specified herein to be furnished by the Government, and performing all work complete in strict accordance with these specifications, and schedules and drawings forming parts thereof for CONSTRUCTION OF KEENEY LANE PUMPING STATION, HARTFORD, CONNECTICUT.

b. Location. - The site of the work is located in the City of Hartford, Connecticut.

c. Appropriation. - 21X3113 - FLOOD CONTROL, GENERAL.

d. Authority. - The work provided for herein is authorized by the Flood Control Act of 28 June 1938 (Public No. 761, 75th Congress, 3rd Session) as modified by the Flood Control Act of 18 August 1941 (Public No. 228, 77th Congress, 1st Session) and the Flood Control Act of 22 December 1944 (Public No. 534, 78th Congress, 2nd Session).

SW-2. PRINCIPAL FEATURES. - The work to be performed includes the following principal features:

a. Demolish certain existing structures.

b. Construct an addition to an existing pumping station, furnish and install certain equipment therein and install other equipment furnished by the Government.

The above general outline of principal features does not in any way limit the responsibility of the Contractor to perform all work and furnish all plant, labor, materials and equipment required by the specifications and the plans and drawings referred to therein.

GENERAL CONDITIONS
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PART II

GENERAL CONDITIONS

GC-1. SCOPE OF WORK. - The work to be performed under this contract consists of furnishing all plant, materials, equipment, supplies, labor and transportation, including fuel, power, water (except any materials, equipment, utility or service, if any, specified herein to be furnished by the Government), and performing all work as required by Article I of the contract, in strict accordance with the specifications, schedules and drawings, all of which are made a part hereof, and including such detail drawings as may be furnished by the Contracting Officer from time to time during the prosecution of the work in explanation of said drawings.

GC-2. CHARACTER OF WORK AND MECHANICS. - The work shall be executed in the best and most workmanlike manner by qualified, careful and efficient mechanics in strict accordance with the drawings and specifications.

GC-3. SITE INVESTIGATION AND REPRESENTATIONS. - The Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, river stages, tides or similar physical conditions at the site, the conformation and condition of the ground, the character, quality and quantity of surface and subsurface materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the work, and all other matters which can in any way affect the work or the cost thereof under this contract. Any failure by the Contractor to acquaint himself with all the available information concerning these conditions will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the work. The Government assumes no responsibility for any understanding or representations made by any of its officers or agents during or prior to the negotiation and execution of this contract, unless (1) such understanding or representations are expressly stated in the contract and (2) the contract expressly provides that responsibility therefor is assumed by the Government. Representations made but not so expressly stated and for which liability is not expressly assumed by the Government in the contract shall be deemed only for the information of the Contractor, and the Government will not be liable or responsible therefor.

GC-4. OPERATIONS AND STORAGE AREAS. - a. All operations of the Contractor (including storage of materials) upon Government premises shall be confined to areas authorized or approved by the Contracting Officer. No unauthorized or unwarranted entry upon, or passage through, or storage or disposal of materials shall be made upon Government premises. Government

premises adjacent to the construction will be made available for use by the Contractor without cost whenever such use will not interfere with other Government uses or purposes. The Contractor shall be liable for any and all damage caused by him to such Government premises. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature or kind arising from any use, trespass or damage occasioned by his operations on premises of third persons.

b. Temporary buildings (storage sheds, shops, offices, etc.) shall be erected by the Contractor only with the approval of the Contracting Officer, and shall be built with labor and materials furnished by the Contractor without expense to the Government. Such temporary buildings and/or utilities shall remain the property of the Contractor, and will be removed by him at his expense upon the completion of the work. With the written consent of the Contracting Officer, such buildings and/or utilities may be abandoned and need not be removed.

c. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways or construct and use such temporary roadways as may be authorized by the Contracting Officer. Where materials are transported in the prosecution of the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any federal, state or local law or regulation. When it is necessary to cross curbings or sidewalks, protection against damage shall be provided by the Contractor, and any damaged roads, curbings, or sidewalks shall be repaired by, or at the expense of the Contractor.

GC-5. BASE LINES AND GRADES. - The Contractor shall lay out his work from base lines and grades established by the Government and shall be responsible for all measurements in connection therewith. The Contractor shall, at his own expense, furnish all stakes, templates, platforms, equipment, ranges and labor that may be required in setting and cutting, or laying out any part of the work. The Contractor will be held responsible for the proper execution of the work to such lines and grades as may be established or indicated by the Contracting Officer, and all stakes or other marks thus established shall be preserved by him until their removal is authorized by the Contracting Officer. The Contracting Officer will furnish, on request from the Contractor, all location and limit marks reasonably necessary for the conduct of the work.

GC-6. PROGRESS CHARTS, AND REQUIREMENTS FOR SUNDAYS, HOLIDAYS AND NIGHT WORK. - a. The Contractor shall, within five days or within such time as determined by the Contracting Officer, after date of commencement of work, prepare and submit to the Contracting Officer for approval a practicable schedule, showing the order in which the Contractor proposes to carry on the work, the date on which he will start the several salient features (including procurement of materials, plant and equipment) and the contemplated dates for completing the same. The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately

the percentage of work scheduled for completion at any time. The Contractor shall enter on the chart the actual progress at the end of each week or at such intervals as directed by the Contracting Officer, and shall immediately deliver to the Contracting Officer three copies thereof.

b. The Contractor shall furnish sufficient forces, construction plant and equipment, and shall work such hours, including night shifts, overtime operations and Sunday and holiday work, as may be necessary to insure the prosecution of the work in accordance with the approved progress schedule. If, in the opinion of the Contracting Officer, the Contractor falls behind the progress schedule, the Contractor shall take such steps as may be necessary to improve his progress, and the Contracting Officer may require him to increase the number of shifts, and/or overtime operations, days of work and/or the amount of construction plant, all without additional cost to the Government.

c. Failure of the Contractor to comply with the requirements of the Contracting Officer under this provision shall be grounds for determination by the Contracting Officer that the Contractor is not prosecuting the work with such diligence as will insure completion within the time specified. Upon such determination the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part thereof, in accordance with the Delays-Damages Article of the contract.

GC-7. SUBCONTRACTORS. - At the request of the Contracting Officer the Contractor will notify the Contracting Officer in writing of the names of all Subcontractors proposed for the work, as well as those Subcontractors who have been engaged previously, together with the extent and character of the work to be done by each Subcontractor. If, for sufficient reason, at any time during the progress of the work, the Contracting Officer determines that any Subcontractor is incompetent or undesirable, he will notify the Contractor accordingly, and immediate steps will be taken for cancellation of such subcontract. Subletting by Subcontractors shall be subject to the same regulations. Nothing contained in this contract shall create any contractual relation between any Subcontractor and the Government.

GC-8. SAMPLES AND DESCRIPTIVE DATA. - a. Any samples and descriptive data required shall:

(1) Be submitted within the time specified in these specifications or, if no time be specified, within a reasonable time before use to permit inspection and testing.

(2) Be shipped prepaid and delivered as specified in these specifications, or as directed by the Contracting Officer.

(3) Be properly marked to show the name of the material, trade name of manufacturer, place of origin, name and location of the

work where the material represented by the sample is to be used, and the name of the Contractor submitting the sample.

b. Samples not subjected to destructive tests may be retained until completion of the work but thereafter will be returned to the Contractor, if he so requests in writing, at his own expense. Failure of any sample to pass the specified requirements will be sufficient cause for refusal to consider further any samples from the same manufacturer whose materials failed to pass the tests.

GC-9. PROTECTION OF MATERIAL AND WORK. - The Contractor shall at all times take care to protect and preserve all materials, supplies and equipment of every description (including property which may be Government-furnished or owned) and all work performed. All reasonable requests of the Contracting Officer to inclose or specially protect such property shall be complied with. If, as determined by the Contracting Officer, material, equipment, supplies and work performed are not adequately protected by the Contractor, such property may be protected by the Government and the cost thereof may be charged to the Contractor or deducted from any payments due to him.

GC-10. PRESERVATION OF EXISTING VEGETATION.-a. The Contractor shall preserve and protect all existing vegetation such as trees, shrubs, and grass on or adjacent to the site which do not unreasonably interfere with the construction as may be determined by the Contracting Officer. The Contractor shall be responsible for all unauthorized cutting or damaging of trees and shrubs, including damage due to careless operation of equipment, stock piling of materials or tracking of grass areas by equipment.

b. Care will be taken by the Contractor in felling trees authorized for removal to avoid any unnecessary damage to vegetation that is to remain in place. Any limbs or branches of trees broken during such operations, shall be trimmed with a clean cut and painted with an approved tree pruning compound if required by the Contracting Officer. The Contractor will be liable for or may be required to replace or restore at his own expense all vegetation not protected and preserved as required herein that may be destroyed or damaged.

GC-11. POSSESSION PRIOR TO COMPLETION. - The Government shall have the right to take possession of or use any completed or partially completed part of the work. Such possession or use shall not be deemed an acceptance of any work not completed in accordance with the contract. If such prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment in the contract price and/or the time of completion will be made and the contract shall be modified in writing accordingly.

GC-12. SUSPENSION OF WORK. - The Contracting Officer may order the Contractor to suspend all or any part of the work for such period of time as may be determined by him to be necessary or desirable for the convenience of the Government. Unless such suspension unreasonably

delays the progress of the work and causes additional expense or loss to the Contractor, no increase in contract price will be allowed. In the case of suspension of all or any part of the work for an unreasonable length of time causing additional expense or loss, not due to the fault or negligence of the Contractor, the Contracting Officer shall make an equitable adjustment in the contract price and modify the contract accordingly. An equitable extension of time for the completion of the work in the event of any such suspension will be allowed the Contractor, provided, however, that the suspension was not due to the fault or negligence of the Contractor.

GC-13. ACCIDENT PREVENTION, FIRE PREVENTION, AND SANITATION. - The handbook, "Safety Requirements", approved by the Chief of Engineers 16 December 1941, as revised 1 January 1946 (copy of which is on file in the office of the authorized representative of the Contracting Officer on the project), and as may be amended, will govern in the prosecution of the work in accordance with the Accident Prevention Article of the contract.

GC-14. LABOR REPORTS. - As required by the Department of Labor, the Contractor shall promptly furnish, and shall cause any Subcontractors to furnish in like manner, within seven days after the regular payment date of each weekly payroll, to the Contracting Officer, a copy of such payroll, together with a sworn affidavit with respect to the wages paid each of its employees (which shall not be deemed to apply to persons in classifications higher than laborer and mechanic and those who are the immediate supervisors of such employees) engaged on the work. In addition, the Contractor shall furnish, and cause any Subcontractors to furnish in like manner, an additional copy of the payroll, together with the sworn affidavit as indicated herein for the weekly payroll period ending nearest January 15, April 15, July 15 and October 15. The Contractor shall also prepare and furnish such other labor reports as may be required by the Department of Labor.

GC-15. CLEANING UP. - The Contractor shall at all times keep the construction area, including storage areas used by him, free from accumulations of waste material or rubbish, and prior to completion of the work remove any rubbish from and about the premises and all tools, scaffolding, equipment and materials not the property of the Government. Upon completion of the construction, the Contractor shall leave the work and premises in a condition satisfactory to the Contracting Officer.

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PART III

SPECIAL CONDITIONS

SC-1. COMMENCEMENT, PROSECUTION AND COMPLETION. - The Contractor will be required to commence work under this contract within fifteen (15) calendar days after the date of receipt by him of notice to proceed, to prosecute said work with faithfulness and energy, and to complete the entire work ready for use not later than five hundred and twenty-five (525) calendar days after the date of receipt by him of notice to proceed. The time stated for completion shall include final clean-up of the premises.

SC-2. ESTIMATED QUANTITIES. - The quantities listed below are estimates only. Within the limit of available funds the Contractor will be required to complete the work specified herein in accordance with the contract and at the contract price or prices whether it involves quantities greater or less than the following estimates:

Item No.	Estimated Quantities	Unit	Description of Item
1	-	job	Preparation of Site
2	-	job	Control of Water and Sewage
3	4,250	cu.yd.	Common excavation - General
4	-	job	Removal of Existing Structures and Appurtenances
5	2,100	cu.yd.	Compacted Backfill
6	335	cu.yd.	Pit-Run Gravel
7	810	bbl.	Portland Cement
8	375	cu.yd.	Concrete
9	260	cu.yd.	Concrete
10	88,900	lb.	Steel Reinforcement
10A	9,000	sq.ft.	Absorptive Form Lining
11	-	job	Pumping Station Superstructure
12	16,000	lb.	Miscellaneous Iron and Steel
13	1,800	lb.	Miscellaneous Pipe and Fittings
14	2	each	Mechanically Cleaned Bar Screens
15	-	job	Sluice Gates, Complete with Hoists
16	-	job	Heating and Ventilating Equipment
17	-	job	Electric Light and Power System
18	-	job	Gasoline-Electric Standby Unit
19	-	job	Traveling Crane
20	-	job	Water Supply and Plumbing Fixtures
21	-	job	Carbon Dioxide Fire Extinguishing Equipment
22	-	job	Sump Pump
23	-	job	Gasoline Tank and Piping
24	-	job	Diesel Fuel Tank and Piping
25	-	job	Float Gage (Recording)
26	-	job	Installing Equipment Furnished by the Government
27	40	cu.yd.	Topsoil
28	240	sq.yd.	Seeding
29	900	sq.yd.	Grading
30	390	sq.yd.	Bituminous Macadam Pavement
31	500	sq.yd.	Timber Sheet Piling
32	-	job	Rubbish Hoist and Sidewalk Doors

SC-3. PAYMENTS. - Payments will be made as provided in Article 16 of the contract. Unless otherwise authorized in writing by the Contracting Officer, the items of work for which payment will be made shall be limited to those listed and enumerated in the contract. The unit prices or lump sum price or prices stated in the contract will be used in determining the amount to be paid and shall constitute full and final compensation for all the work.

SC-4. CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS. - a. The work shall conform to the following contract drawings and maps, all of which form a part of these specifications and are available in the Corps of Engineer Office, 31 St. James Avenue, Boston 16, Mass.:

LIST OF DRAWINGS

Sheet No.	Title	File No.
1	Project Location and Index	CT-4-3218
2	Hydrograph No. 1	CT-3-1228
3	Hydrograph No. 2	CT-3-1229
4	Subsurface Explorations	CT-2-1390
5	Plot Plan	CT-4-3219
6	Intake, Pump Room and Outlet-Plan	CT-4-3220
7	Intake Structure - Profile and Sections	CT-4-3221
8	Engine Room Floor Plan - Architectural	CT-4-3222
9	Roof Plan and Details - Architectural	CT-4-3223
10	South Elevation and Cast Stone Details - Architectural	CT-4-3224
11	South Elevation Details - Architectural	CT-4-3225
12	East and West Elevations and Details - Architectural	CT-4-3226
13	North Elevation and Details - Architectural	CT-4-3227
14	Longitudinal Section - Architectural	CT-4-3228
15	Transverse Sections - Architectural	CT-4-3229
16	Main Entrance and Details - Architectural	CT-4-3230
17	Structural Steel Framing	CT-4-3231
18	Structural Steel Details No. 1	CT-4-3232
19	Structural Steel Details No. 2	CT-4-3233
20	Roof Slab Steel Reinforcement No. 1	CT-4-3234
21	Roof Slab Steel Reinforcement No. 2	CT-4-3235
22	Engine Room Floor Slab Steel Reinforcement No. 1	CT-4-3236
23	Engine Room Floor Slab Steel Reinforcement No. 2	CT-4-3237
24	Engine Room Floor Slab Steel Reinforcement No. 3	CT-4-3238
25	Slab Details of Screening Room, Boiler Room and Conduit Roofs	CT-4-3239
26	Base Slab Steel Reinforcement No. 1	CT-4-3240
27	Base Slab Steel Reinforcement No. 2	CT-4-3241

LIST OF DRAWINGS (Cont'd.)

Sheet No.	Title	File No.
28	North Wall	CT-4-3242
29	West Wall	CT-4-3243
30	South Wall - Sections E and F	CT-4-3244
31	South Wall - Sections G and H	CT-4-3245
32	Vertical Sections	CT-4-3246
33	Horizontal Sections	CT-4-3247
34	Dividing Wall at Pump Room and Suction Conduit Wall Details	CT-4-3248
35	Screening Room, Interior Wall Details	CT-4-3249
36	Concrete Stairway Details	CT-4-3250
37	Intake Conduit and Tank Base Details	CT-4-3251
38	Miscellaneous Steel Details No. 1	CT-4-3252
39	Miscellaneous Steel Details No. 2	CT-4-3253
40	Miscellaneous Steel Details No. 3	CT-4-3254
41	Miscellaneous Steel Details No. 4	CT-4-3255
42	General Arrangement of Equipment No. 1	CT-4-3256
43	General Arrangement of Equipment No. 2	CT-4-3257
44	General Arrangement of Equipment No. 3	CT-4-3258
45	General Arrangement of Equipment No. 4	CT-4-3259
46	Piping Layout - Gasoline, Diesel and Fuel Oil Lines	CT-4-3260
47	General Installation Details	CT-4-3300
48	Gasoline, Diesel, Fuel Oil and Ventilating Piping Details	CT-4-3261
49	Piping Layout - Plumbing and Valve Control Lines	CT-4-3262
50	Details of Auxiliary Hydraulic Valve Control and Engine Cooling Water Systems	CT-4-3263
51	Piping Layout - Fire Extinguishing System	CT-4-3264
52	Heating	CT-4-3265
53	Electric Light and Power System No. 1	CT-4-3266
54	Electric Light and Power System No. 2	CT-4-3267
55	Electric Light and Power System No. 3	CT-4-3283
56	Electric Light and Power System No. 4	CT-4-3284

b. Ten (10) sets of contract drawings, maps and specifications will be furnished the Contractor without charge. Additional sets will be furnished on request at the cost of reproduction.

c. The Contractor shall submit to the Contracting Officer for approval four (4) copies of all shop drawings as called for under the various headings of these specifications. These drawings shall be complete and shall contain all required detailed information. If approved by the Contracting Officer, each copy of the drawings will be identified as having received such approval by being so stamped and dated. The Contractor shall make any corrections required by the Contracting Officer. Three (3) sets of all shop drawings will be retained by the Contracting Officer and one set will be returned to the Contractor. The approval of the drawings by the Contracting Officer shall not be construed as a complete check but will indicate only that the general

method of construction and detailing is satisfactory. Approval of such drawings will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor shall be responsible for the dimensions and design of adequate connections, details and satisfactory construction of all work.

SC-5. PHYSICAL DATA. - The information and data furnished or referred to below are not intended as representations or warranties but are furnished for information only. It is expressly understood that the Government will not be responsible for the accuracy thereof or for any deduction, interpretation, or conclusion drawn therefrom by the Contractor.

a. Subsurface investigation. - (1) Borings. - Borings have been made at the site and in the vicinity of the proposed work and laboratory analyses have been made of the samples of materials taken from some of the borings. The boring samples and the results of the studies and analyses pertaining to them may be examined at the Soils Laboratory, New England Division, Corps of Engineers, War Department, Watertown Arsenal, Building 39, Watertown, Massachusetts.

(2) Hydrograph. - Hydrographic data shown on Drawings File Nos. CT-3-1228 and CT-3-1229 were obtained from the United States Weather Bureau.

b. Weather conditions. - The locality is subject to atmospheric temperatures ranging from minus 18 degrees to plus 101 degrees Fahrenheit. The mean annual precipitation at Hartford is 44.90 inches. The mean monthly precipitation varies from a low of 3.08 inches in June to a high of 4.37 inches in July.

c. Transportation facilities. - (1) Railroads. - The New York, New Haven and Hartford Railroad serves the City of Hartford with main line traffic. The Contractor shall investigate the availability of the sidings and make all arrangements for their use for the delivery of any materials and equipment to be used on the work.

(2) Highways. - First-class highways also serve the City. The Contractor shall provide for his own construction or access roads and their maintenance. He shall make his own investigation of available roads for transportation, of load limits for bridges and roads, and other road conditions affecting the transportation of materials and equipment to the site of the work.

SC-6. DATUM AND BENCH MARKS. - The plane of reference of mean sea level datum as used in these specifications is that determined by the following bench mark:

a. Location and Description. - At north entrance to Hartford Post Office on east side of steps about 2 feet above sidewalk; standard disc in the upper surface of granite guard block.

b. Elevation. (M.S.L.) 62.417 feet

c. Identification Tidal Bench Mark 5

SC-7. BONDS. - a. Payment Bond. - If the contract price exceeds $2,000.00, the Contractor agrees to furnish a payment bond with good and sufficient surety or sureties acceptable to the Government for the protection of persons furnishing material or labor in connection with the performance of the work under this agreement on U. S. Standard Form No. 25-A or U. S. Standard Form No. 25-C. The penal sum of such payment bond will be as follows: (1) When the contract price is $1,000,000 or less, 50% of the contract price; (2) When the contract price is in excess of $1,000,000 and less than $5,000,000, 40% of the contract price; (3) When the contract price is $5,000,000 or more, $2,500,000.00.

b. Performance Bond. - If the contract price exceeds $2,000.00, the Contractor further agrees to furnish a performance bond with good and sufficient surety or sureties acceptable to the Government in connection with the performance of the work under this agreement on U. S. Standard Form No. 25 or U. S. Standard Form No. 25-B. The penal sum of such performance bond will be 50 per cent of the contract price (the penal sum of the performance bond will be the same as the penal sum of the payment bond unless otherwise indicated herein).

c. Any bonds required hereunder will be dated as of the same date as the contract and shall be furnished by the Contractor to the Government at the time the contract is executed.

SC-8. PATENT INDEMNITY. - The Contractor agrees to indemnify the Government, its officers, agents, servants and employees, against liability including costs and expenses for infringement upon any Letters Patent of the United States (except Letters Patent issued upon an application which is now or may hereafter be ordered to be kept secret under the provisions of the Act of October 6, 1917, as amended, 35 U.S.C. 42) occurring in the performance of this contract or arising (in respect only of inventions which are actually embodied in items manufactured or supplied hereunder, or are involved in the use, unless there be more than one practicable use, of such items) by reason of the use or disposal of such items by or for the account of the Government.

SC-9. RATES OF WAGES. - a. The minimum wages to be paid laborers and mechanics on this project, as determined by the Secretary of Labor to be prevailing for the corresponding classes of laborers and mechanics employed on projects of a character similar to the contract work in the pertinent locality, are as set forth below.

b. Any class of laborers and mechanics not listed below, employed on this contract, shall be classified or reclassified conformably to the schedule set out below by mutual agreement between the Contractor and class of labor concerned, subject to the prior approval of the Contracting Officer. In the event the interested parties cannot

agree on the proper classification or reclassification of a particular class of laborers and mechanics to be used, the question, accompanied by the recommendation of the Contracting Officer, shall be referred to the Secretary of Labor for final determination.

Classification of Laborers and Mechanics	Minimum Rates of Wages Per Hour
Air tool operators (jackhammermen, vibrator)	$1.125
Asbestos workers	1.5625
Asbestos workers' improvers:	
1st year	.75
2nd year	1.00
3rd year	1.0625
4th year	1.0625
Blacksmiths	1.[illegible]
Boilermakers	1.90
Boilermakers' helpers	1.60
Boilermakers (tank construction)	1.75
Boilermakers (tank construction) helpers	1.50
Bricklayers	1.75
Carpenters, journeymen	1.625
Cement finishers	1.75
Electricians	1.625
Electricians' apprentices:	
1st 6 months 30% of journeymen's rate	
2nd " " 35% " " "	
3rd " " 40% " " "	
4th " " 45% " " "	
5th " " 50% " " "	
6th " " 55% " " "	
7th " " 60% " " "	
8th " " 65% " " "	
9th " " 72½% " " "	
10th " " 80% " " "	
Elevator constructors	1.755
Elevator constructors' helpers	1.22
Firemen and oilers	1.125
Glaziers	1.50
Iron workers, structural	2.00
Iron workers, ornamental	2.00
Iron workers, reinforcing	2.00
Iron workers' apprentices:	
1st 6 months	.90
2nd " "	1.[illegible]
2nd year	1.20
Laborers, building	1.125
Laborers, concrete	1.125
Laborers, unskilled	1.125
Lathers	1.775
Marble setters	1.625
Marble setters' helpers	1.125
Mason tenders	1.125
Mortar mixers	1.125

Classification of Laborers and Mechanics	Minimum Rates of Wages Per Hour
Power equipment operators:	
Air compressors	$1.50
Batching plant operators (asphalt, cement, etc.)	1.50
Blade graders	1.30
Bulldozers	1.30
Cranes, derricks, and draglines	1.825
Distributors (bituminous surfaces)	1.50
Finishing machine (cem. conc. pave.)	1.50
Hoists, 1 drum	1.50
Hoists, 2 or more drums	1.825
Hoists on steel	1.925
Mixers, without loader	1.125
Mixers, with loader	1.50
Motor graders	1.30
Paver operators	1.50
Piledrivers	1.825
Pumps	1.40
Rollers	1.40
Scrapers	1.50
Shovels	1.825
Tractors	1.30
Trenching machines	1.825
Painters, brush	1.50
Painters, structural steel	1.50
Pipelayers (concrete and clay)	1.125
Plasterers	1.75
Plasterers' tenders	1.125
Plumbers	1.65
Plumbers' apprentices:	
1st 6 months 25% of journeymen's rate	
2nd " " 30% " " "	
3rd " " 35% " " "	
4th " " 40% " " "	
5th " " 45% " " "	
6th " " 50% " " "	
7th " " 57½% " " "	
8th " " 65% " " "	
9th " " 72½% " " "	
10th " " 80% " " "	
Roofers, composition	1.375
Roofers, slate and tile	1.75
Roofers, kettlemen	1.25
Sheet metal workers	1.75
Sheet metal workers' apprentices:	
1st 6 months 35% of journeymen's rate	
2nd " " 40% " " "	
3rd " " 45% " " "	
4th " " 50% " " "	
5th " " 55% " " "	
6th " " 60% " " "	
7th " " 70% " " "	
8th " " 80% " " "	

Classification of Laborers and Mechanics	Minimum Rates of Wages Per Hour
Soft floor layers (linoleum)	$1.625
Sprinkler fitters	1.75
Sprinkler fitters' helpers	1.10
Steam fitters	1.75
Stone masons	1.75
Terrazzo workers	1.625
Terrazzo workers' helpers	1.125
Tile setters	1.625
Tile setters' helpers	1.125
Truck drivers, 5 tons or less	.85
Truck drivers, over 5 tons	.90
Truck drivers (concrete mixers)	.97
Welders - receive rate prescribed for craft performing operation to which welding is incidental	
Landscape work:	
Pruners	1.125
Plantsmen	1.125
Fine gradesmen	1.125

SC-10. WATER. - The responsibility shall be upon the Contractor to provide and maintain at his own expense an adequate supply of water of a quantity suitable for his use for construction and domestic consumption. At his own expense he shall install and maintain any necessary water supply connections and piping but only at such locations and in such workmanlike manner as may be authorized by the Contracting Officer. All water shall be carefully conserved. Before final acceptance, temporary connections and piping installed by the Contractor shall be removed in a workmanlike manner to the satisfaction of the Contracting Officer. If it is determined by the Contracting Officer that Government-owned and operated water systems and supplies are adequate for the needs and use of the Contractor as well as the Government, all reasonably required amounts of water will be made available to the Contractor by the Government from such existing water systems and supplies, without cost to the Contractor.

SC-11. ELECTRICITY. - All electric current required by the Contractor shall be furnished at his own expense. All temporary connections for electricity shall be subject to the approval of the Contracting Officer. In the event electricity is made available by the Government, the Contractor shall, at his own expense, install a meter to determine the amount of current used by him, and such electricity shall be paid for by, or will be charged to the Contractor at prevailing rates or at reasonable rates as determined by the Contracting Officer. All temporary lines shall be furnished, installed, connected, and maintained by the Contractor in a workmanlike manner satisfactory to the Contracting Officer, and shall be removed by the Contractor in like manner at his expense prior to completion of the construction.

SC-12. PLANT. - The Contractor agrees to keep on the job sufficient plant to meet the requirements of the work. Plant shall be kept at all times in condition for efficient work, and subject to the inspection of the Contracting Officer. No reduction in the capacity of the plant employed on the work shall be made except by written permission of the Contracting Officer. The measure of the "capacity of the plant" shall be its actual performance on the work to which these specifications apply.

SC-13. INSPECTION. - The work will be conducted under the general direction of the Contracting Officer and is subject to inspection by his appointed inspectors to insure strict compliance with the terms of the contract. The inspectors will direct the maintenance of the gages, ranges, location marks and limit marks in proper order and position. No inspector is authorized to change any provision of the specifications without written authorization of the Contracting Officer, nor shall the presence or absence of an inspector relieve the Contractor from any requirements of the contract.

SC-14. PROTECTION OF EXISTING STRUCTURES, UTILITIES AND WORK. - The Contractor shall protect all existing structures, utilities and work of any kind against damage or interruption of service. Damage or interruption of service resulting from failure so to do shall be repaired or restored promptly by or at the expense of the Contractor.

SC-15. DAMAGE TO WORK. - The Contractor shall be responsible for all work until completion and final acceptance thereof. However, if, in the judgment of the Contracting Officer, any part of the permanent work performed by the Contractor is damaged by flood, which damage is not due to the failure of the Contractor to take reasonable precautions or to exercise sound engineering and construction practices in the conduct of the work, additional payment for the repair of such damaged permanent work as ordered by the Contracting Officer will be made at the applicable contract unit or lump sum prices as fixed and established in the contract, which shall be full compensation therefor. If, in the opinion of the Contracting Officer, there are no contract unit or lump sum prices applicable to a part of such work, an equitable adjustment pursuant to Article 3 - Changes of the contract will be made as full compensation for the repairs of that part of the permanent work for which there are no applicable contract unit or lump sum prices. Except as herein provided, damage to all work, (including temporary construction) utilities, materials, equipment and plant shall be repaired to the satisfaction of the Contracting Officer at the Contractor's expense, regardless of the cause of such damage.

SC-16. LIQUIDATED DAMAGES. - In case of failure on the part of the Contractor to complete the work within the time fixed in the contract or any extensions thereof, the Contractor shall pay the Government as liquidated damages the sum of fifty dollars ($50.00) for each calendar day of delay until the work is completed or accepted.

SC-17. GOVERNMENT-FURNISHED MATERIALS OR EQUIPMENT. - The Government will furnish to the Contractor as free issue the following materials and equipment to be incorporated or installed in the work or used in its performance. Such materials and equipment will be furnished f.o.b. railhead nearest the project site, or f.o.b. truck at the project site, and the Contractor will be required to accept delivery when made, pay any demurrage incurred, and unload and transport the materials or equipment to the job site at his own expense. All such materials or equipment shall be installed and/or incorporated into the work at the expense of the Contractor, unless otherwise indicated herein. Any materials or equipment so furnished which are excess, upon the completion of the work, shall remain the property of the Government. The Contractor shall check the quantity and condition of such Government-furnished material or equipment when delivered to him, acknowledge receipt thereof in writing to the Contracting Officer, and in case of damage to or shortage of such material or equipment, he shall, within 24 hours, report in writing such damage and/or shortage to the Contracting Officer.

Quantity	Item	Description
3	Pump	36" - vertical shaft, volute type
3	Gate valve	36" - hydraulically operated, flanged
3	Gate valve	36" - hydraulically operated with one bell face and one flange
3	Check valve	36" - hydraulically operated with one spigot and one flange
3	Pipe coupling	36" - flexible
2	Wall casting	36" - suction
1	Wall casting	36" - discharge
6	Pipe length	36" - flanged one end
1	Pipe length	36" - flanged both ends
3	Gear Unit	300 H.P. right angle
3	Gasoline Engine	300 H.P. complete with silencer; exhaust piping; connections to exhaust, water and fuel lines; and flexible couplings to the gear reduction units
1	Pump	16" - vertical shaft, volute type
1	Diesel engine	75 H.P. complete with silencer, exhaust piping; connections to exhaust, water and fuel lines; and flexible coupling to gear reduction unit
1	Gear Unit	75 H.P. right angle
1	Gate valve	16" - hand-operated
1	Gate valve and floorstand	16" - hand-operated
1	Check valve	16" - horizontal
2	Pipe coupling	16" - flexible
1	45° lateral & blank flange	16" - special
1	45° - base elbow	16" - square base
4	Pipe length	16" - flanged one end
1	Plaque	Bronze
1	Grille	Bronze

Fuels and lubricants (see Paragraph TP16-9)

SC-18. OBSTRUCTION AND DANGER LIGHTS. - In addition to the requirements of Paragraph GC-13 of these specifications, the Contractor shall comply with all State and local laws and regulations relating to obstruction and danger lights and shall provide, erect and maintain, at no additional expense to the Government, all necessary safeguards, including barricades, warning signs, lights and watchmen.

SC-19. FINAL EXAMINATION AND ACCEPTANCE. - As soon as practicable after the completion of the entire work or any divisible part thereof as may be designated in these specifications, a thorough examination thereof will be made by the Contracting Officer at the site of the work. If such work is found to comply fully with the requirements of the contract, it will be accepted, and final payment thereof will be made in accordance with Article 16 of the contract.

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PART IV

TECHNICAL PROVISIONS

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TP1-1. WORK INCLUDED. - The Contractor shall clear, grub and dispose of all materials within the construction limits, including the site of the pumping station and appurtenant structures, seeded areas, parking areas and driveways as shown on the drawings or as directed by the Contracting Officer.

TP1-2. CLEARING. - Trees and other obstructions shall be removed by the Contractor from the sites of the proposed structures when and as directed by the Contracting Officer and may be removed from other areas only to the extent directed or permitted. The Contractor shall preserve and protect from injury all trees and structures not required to be removed.

TP1-3. GRUBBING. - a. The areas to be grubbed shall include those areas previously cleared as directed by the Contracting Officer.

b. All such areas shall be thoroughly grubbed of all stumps, roots, buried logs, and other objectionable matter. Tap roots and other projections over 1-1/2 inches in diameter within the limits of construction shall be grubbed out to a depth at least 3 feet below the ground surface, unless otherwise directed by the Contracting Officer.

TP1-4. DISPOSAL OF MATERIALS. - All materials removed, as specified above, shall be disposed of by burning or by removal to approved disposal areas as directed by the Contracting Officer. At no time shall material be placed on land adjacent to the construction area.

TP1-5. PAYMENT. - Payment for all work in connection with the preparation of the site as above specified will be made at the contract price for Item 1, "Preparation of Site".

PART IV

SECTION II. CONTROL OF WATER AND SEWAGE (Item 2)

TP2-1. WORK INCLUDED. - a. All permanent construction shall be carried on in areas free from water, unless otherwise authorized by the Contracting Officer. Special care shall be taken to prevent the foundation areas of the proposed structures and fills from becoming unstabilized by flow of ground water into the excavations. Where excavation extends below existing ground water level, the Contractor shall lower the elevation of ground water, by the use of approved methods, a minimum of two feet below the bottom of the excavation and in advance of the excavation operations for the pumping station, intake and outlet structures. The ground water level shall be maintained two feet below the lowest excavation elevation until sufficient concrete has been placed in the substructure base and walls, as determined by the Contracting Officer. The Contractor shall install and maintain in good working order not less than three observation wells of 2-inch pipe as approved by the Contracting Officer.

b. The Contractor shall maintain existing operating sewers during construction so their discharges are unimpeded, and shall divert the water from the permanent work by the construction of a bulkhead in the existing diversion chamber.

c. The Contractor shall operate the gate at the river end of the Keeney Lane Outlet conduit in such a manner that will prevent flood waters in the river from entering the protected area through the conduit. During the construction of the Keeney Lane Pumping Station, the Contractor shall maintain in operation the remote control push button board for the river front gates of the discharge conduits for the existing Potter Street Station and the Keeney Lane Outlet Conduit.

TP2-2. MAINTAINING EXISTING SEWERS. - Provisions shall be made to maintain the satisfactory operation of existing sewers throughout the construction period, unless otherwise authorized by the Contracting Officer.

TP2-3. PAYMENT. - Payment for control of water and sewage during construction, the construction of observation wells, the construction and maintenance of temporary diversion bulkheads and the rebuilding of bulkheads in case of destruction will be made in one sum at the contract price for Item 2 "Control of Water and Sewage", when, in the opinion of the Contracting Officer, the permanent construction no longer requires the protective measures specified herein and when such protective measures have been removed to the satisfaction of the Contracting Officer.

PART IV

SECTION III. COMMON EXCAVATION - GENERAL (Item 3)

TP3-1. GENERAL PROVISIONS. - a. Scope of work. - The location and character of the proposed structures, and the location and logs of borings are shown on the drawings. The Contractor shall excavate to the lines and grades shown on the drawings, but the right is reserved to modify any part of the work if, in the opinion of the Contracting Officer, conditions require such modification.

b. Disposal of material. - Suitable material from the excavations needed for backfill shall be stockpiled and used in the permanent construction as directed by the Contracting Officer. Materials from the required excavations not needed or unsuitable for use in the permanent construction shall be wasted in the spoil area shown on the drawings or as directed by the Contracting Officer. After completion of the excavation, spoil areas shall be graded and dressed neatly to the satisfaction of the Contracting Officer.

c. Measurement. - (1) Excavation will be measured by the cubic yard in place and the volume thereof will be computed between the original ground surface as determined by a survey made just prior to the commencement of the work and the pay lines shown on the drawings.

(2) Where pay lines are not shown on the drawings, measurement by the cubic yard will be made of the volume between the original surface as determined from the survey made just prior to the commencement of the work and the lines and grades established by the Contracting Officer.

d. Payment. - (1) Items included. - The contract price for excavation shall include the cost of excavating, loading, hauling and disposal of the material in the backfills or spoil areas, including any stockpiling and rehandling, and the grading and dressing of spoil areas.

(2) Pay lines. - Payment for all structure excavations will be made to the pay or slope lines shown on the drawings, or such modifications of said lines as may be found necessary by the Contracting Officer, regardless of whether or not it is necessary to remove the material to slopes greater or less than those shown. No payment will be made for excavation outside of the limits described above, but the Contractor will be required to backfill any such excess excavation with approved material, or with additional concrete where excess excavations are adjacent to concrete structures, at no additional expense to the Government.

(3) Shoring. - where approved by the Contracting Officer, shoring may be used in lieu of excavation to the slope or pay

lines as herein specified. However, if the use of shoring is deemed necessary by the Contracting Officer, he may direct its use. Shoring shall be erected in a safe and workmanlike manner, and shall be placed in such a way as to afford ready inspection of and ample clearance for the permanent work. Shoring shall be removed upon completion of the permanent work or as soon as the construction does not require its use. No additional payment will be made for temporary shoring, but the cost thereof shall be included in the contract price for the excavation. Where shoring is used in lieu of excavating to the pay lines, measurement for payment for excavation will be made to the pay lines specified in subparagraph (2) above.

(4) Temporary drains. - The Contractor shall maintain the site of the work and adjacent grounds in a well drained condition. Temporary drains and ditches required shall be constructed by the Contractor at no additional expense to the Government.

TP3-2. COMMON EXCAVATION - GENERAL (Item 3). - a. Work included. - The Contractor shall excavate and dispose of the materials classified as common excavation - general, above and below the mean water level in the river to the lines and grades shown on the drawings or as directed by the Contracting Officer. Excavation shall be performed in accordance with a schedule of operations to be approved by the Contracting Officer. Common excavation - general shall include all excavation for the pumping station, inlet conduit, suction chamber, discharge conduit, and any other required common excavation for structures.

b. Disposal of materials. - The provisions of Paragraph TP3-1 b shall apply. Excavated materials not used in permanent construction may be used in temporary construction if approved by the Contracting Officer. Materials for backfill (see Paragraph TP5-1) shall be stockpiled in the vicinity of the work for later use.

c. Measurement and payment. - Measurement for excavation work will be made as specified in Paragraph TP3-1 c. Payment for all work in connection with excavation will be made at the contract unit price for Item 3 "Common Excavation - General".

PART IV

SECTION IV. REMOVAL OF EXISTING STRUCTURES AND APPURTENANCES (Item 4)

TP4-1. WORK INCLUDED. - a. - The Contractor shall remove the temporary concrete west wall, concrete structures, pipe, pumping equipment, and other appurtenances, at the temporary Keeney Lane pumping station, as shown on the drawings, and shall remove the existing Keeney Lane pumping station superstructure, as herein specified and as directed by the Contracting Officer.

b. The removal of existing utilities, required to permit the orderly prosecution of the work covered by the specifications, will be accomplished by local agencies, unless otherwise shown on the drawings. Whenever a telephone or telegraph pole, pipe line, conduit, fence, sewer, or other utility is encountered, and must be removed to permit completion of the work, the Contracting Officer will request the proper local authorities to remove the designated utility promptly. No additional payment will be made to compensate the Contractor for delays in his work due to failure of any utility to be removed promptly.

TP4-2. REMOVING EXISTING PUMPING EQUIPMENT. - a. - The Contractor shall remove the existing pumping equipment, consisting of one 36-inch volute pump with suction elbow and sole plates, two 36-inch gate valves, one 36-inch check valve, one 300 horsepower gasoline engine with battery and silencer, one right angle gear unit with vertical shafting, miscellaneous piping and accessories and shall transport this equipment to the North Meadows Pumping Station where it shall be stored on the engine room floor as directed by the Contracting Officer. The pump shall be dismantled as necessary to pass it through the door of the North Meadows Pumping Station and shall be reassembled. After all the pumping equipment has been stored on the engine room floor of the North Meadows Pumping Station, the equipment shall be turned over to the Contracting Officer for installation by others.

b. Subject to the approval of the Contracting Officer, methods of removal and transportation of the equipment will be the responsibility of the Contractor. Materials or equipment which are lost, broken or damaged by negligence or carelessness in removing, transporting or storing shall be replaced by the Contractor to the satisfaction of the Contracting Officer, at no additional expense to the Government.

c. The removal, transporting and storing of the pumping equipment shall be accomplished within one hundred (100) days after the date of receipt of notice to proceed.

TP4-3. REMOVING EXISTING CONCRETE STRUCTURES. - a. - The Contractor shall remove the concrete structures from the location of the existing temporary Keeney Lane pumping station, as shown on the drawings and as herein specified. Material removed shall be disposed of as directed by the Contracting Officer.

b. The existing trash rack chamber and the west wall of the existing Keeney Lane pumping station shall be removed. Extreme care shall be taken in removing the concrete around the copper water stops

which shall be left attached to the permanent structure, except copper water stops around pilasters. Around pilasters the Contractor shall remove copper water stops and dress up the pilasters satisfactory to the Contracting Officer.

c. The sections of concrete conduit at each end of the 72-inch concrete pipe shall be removed in their entirety.

d. The concrete monolith plug shall be carefully removed and all surfaces of the permanent structure thus exposed shall be left in a smooth and even condition satisfactory to the Contracting Officer. The plug contains no reinforcing steel.

e. The existing concrete support for the 36-inch pump at the existing Keeney Lane pumping station shall be removed after the pump has been removed. Concrete and reinforcing steel shall be removed under the pump support to 2 inches below the floor level. The 2-inch depression shall then be brought flush with the existing floor using a mortar of 1 part cement and 2 parts approved clear coarse sand, all in a manner satisfactory to the Contracting Officer.

TP4-4. REMOVING EXISTING 72-INCH CONCRETE PIPE. - a. - The Contractor shall remove the 72-inch concrete pipe, at the existing Keeney Lane pumping station, as shown on the drawings and herein specified.

b. The 72-inch concrete pipe is in twelve sections of 4-foot lengths joined together with mastic joints. The Contractor shall disconnect and remove the concrete pipe. The pipe shall be removed from the site of the work and will become the property of the Contractor.

TP4-5. REMOVING EXISTING PUMPING STATION SUPERSTRUCTURE. - a. - The Contractor shall remove the existing Keeney Lane pumping station superstructure as herein specified.

b. The existing wood superstructure, including the warm-air furnace, will become the property of the Contractor. The Contractor, at his option, shall either demolish the building, or, if he desires to use the structure temporarily for his own purposes, he shall remove the building to a location where it will not interfere with the work. If the Contractor chooses to re-use the structure for the duration of the work under this contract, he shall, upon completion of the work, remove the building and restore the ground surface upon which it has been placed, to its original condition by grading, topsoiling, and seeding. No separate payment will be made for this grading, topsoiling, and seeding, and the work shall be performed by theContractor at no additional expense to the Government.

TP4-6. PAYMENT. - a. - Payment for all removal as specified above will be made at the contract price for Item 4 "Removal of Existing Structures and Appurtenances".

b. All earth excavation necessary for removal of concrete structures and pipe will be paid for under Item 3.

PART IV

SECTION V. MISCELLANEOUS BACKFILL (Items 5 and 6)

TP5-1. COMPACTED BACKFILL (Item 5). - a. Work included. - The Contractor shall place, grade, and consolidate materials required for compacted backfill for the inlet conduit, pumping station, suction chamber, discharge conduit and other structures as shown on the drawings and elsewhere as directed.

b. Materials. - Materials shall be obtained from stockpiles of excavated materials (see Paragraph TP3-1 b). Backfill material shall be free from stumps, roots, sod, rubbish, or other unsuitable materials.

c. Placing. - (1) Where backfill is to be placed against only one side of a concrete wall or other structure, no backfill material shall be placed until the concrete wall or other structure has been in place at least 14 days. No backfill shall be compacted, nor placed by dragline, clamshell, or other equipment which drops the material in relatively large quantities, nor spread by equipment operating closer to the wall than the height of the wall, until the concrete has been in place at least 14 days.

(2) The backfills shall consist of materials suitable for the purpose as determined by the Contracting Officer, and shall be placed in successive layers of not more than 12 inches in depth for the full width of the cross sections. Each layer shall be compacted thoroughly as approved by the Contracting Officer.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of compacted backfill, complete in place and accepted, as measured after compaction. Where shoring or excavation to slopes greater or less than those shown on the drawings is used in lieu of excavating to pay lines, measurements for backfill will be made to the pay lines specified in Paragraph TP3-1 d (2). Payment for compacted backfill will be made at the contract unit price for Item 5 "Compacted Backfill".

TP5-2. PIT-RUN GRAVEL (Item 6). - a. Work included. - The Contractor shall place 12 inches of pit-run gravel as a base for the parking area and driveways. The Contractor shall also place a layer of pit-run gravel under the pumping station, inlet conduit, discharge conduit, and suction chamber of a thickness shown on the drawings or as directed by the Contracting Officer. The applicable provisions of placing as specified in subparagraph d below shall be adhered to.

b. Material. - The material shall consist of pit-run gravel composed of hard, durable particles free from clay lumps and organic

material. The material shall be composed of sizes within the gradation given below and shall be well graded with no predominance of any one size.

Sieve	Amount Passing Total Per Cent by Weight
3-inch	100
1-inch	60 - 100
4 meshes per inch	30 - 75
10 meshes per inch	15 - 50
48 meshes per inch	3 - 20
200 meshes per inch	0 - 5

The material shall also conform to the following requirement: Per cent of wear, Los Angeles Test, A.A.S.H.O. T-96-38, after 500 revolutions not more than 50. If the material as received fails to maintain suitable proportions or is not well graded between the maximum and minimum sizes specified, it shall be rejected or mixed in such manner as to furnish a material meeting the above requirements. Sources of this material shall be as approved by the Contracting Officer prior to use, and the Contractor shall indicate the sources proposed in sufficient time to allow sampling and testing of the material. Pit-run gravel is not available to the Contractor in locations on the site.

c. Subgrade. - (1) Parking area and driveways. - Prior to placing the pit-run gravel base for the parking area and driveways, the Contractor shall grade the subgrade as shown on the drawings or as directed by the Contracting Officer. Any rut's or loose subgrade shall be reshaped and compacted by suitable equipment to the satisfaction of the Contracting Officer.

(2) Pumping station, inlet conduit, discharge conduit and suction chamber. - The Contractor shall level-off the subgrade, of the pumping station, inlet conduit, discharge conduit and suction chamber, during the excavation, in a manner satisfactory for placement of pit-run gravel. No additional payment will be made for the leveling work of this excavation.

d. Placing. - (1) Parking area and driveways. - After the subgrade has been properly prepared and compacted and proper drainage provided, the pit-run gravel shall be spread evenly by means of approved spreader vehicles or trucks to such a depth or depths that, after rolling, it shall conform to the required grade and cross section. The material shall be placed in layers not exceeding 6 inches in thickness. The material as spread shall be well graded with no pockets of fine material or segregation of large and fine particles. After being spread evenly, the material shall be thoroughly compacted by rolling with a self-propelled roller weighing not less than 10 tons, until there is no sinking or creeping ahead of the roller and a firm even surface and required density are obtained. Any portion of the base course which is not accessible to a roller shall be compacted

thoroughly with hand tampers weighing not less than 50 pounds, the face of which shall not exceed 100 square inches in area. The Contractor shall provide suitable means for applying water to the gravel base. Water shall be added as directed to facilitate compaction by substantial saturation of the gravel.

(2) Pumping station, inlet conduit, discharge conduit and suction chamber. - Pit-run gravel shall be placed in successive layers not exceeding 6 inches in thickness and shall be compacted by tamping with hand or power tampers to the required grades and cross sections or as directed by the Contracting Officer. The degree of compaction shall be equivalent to that obtained by compacting with tractor equipment. The material as spread shall be well graded with no pockets of fine material or segregation of large and fine particles.

e. Test requirements. - (1) Parking area and driveways. - Test samples will be taken at such intervals as will give, in the opinion of the Contracting Officer, a comprehensive knowledge of the material and its placement and compaction in each of the sections of the gravel bases. Compaction of the gravel courses shall attain at least 97 per cent degree of compaction as determined by the Contracting Officer in tests for maximum and minimum density of the soil.

(2) Pumping station, inlet conduit, discharge conduit and suction chamber. - No tests will be required.

f. Measurement and payment. - (1) Measurement will be made by the cubic yard for the amount of pit-run gravel furnished and placed in the completed work to the lines and grades shown on the drawings or as directed by the Contracting Officer. Quantities will be measured in place after compaction. Payment will be made at the contract unit price for Item 6 "Pit-Run Gravel", including the disposal of excess materials.

(2) All costs of preparing the subgrade for the parking area and driveways shall be included under Item 6 "Pit-Run Gravel".

PART IV

SECTION VI. CONCRETE (Items 7 to 10A, incl.)

TP6-1. SCOPE OF THE WORK. - The work covered by this section consists of the manufacture, transporting, placing, finishing and curing of concrete in the structures included in these specifications.

TP6-2. COMPOSITION. - Concrete shall be composed of Portland cement, water, fine and coarse aggregate. The design of concrete mixtures will be based on the water-cement ratio necessary to secure (a) a plastic, workable mixture suitable for the specific conditions of placement and (b), when properly cured, a product having durability, impermeability and strength in accordance with all the requirements of the structures covered by these specifications. The mixtures will be designed by the Contracting Officer.

TP6-3. WATER CONTENT. - The water content of all concrete mixtures shall be the minimum necessary to properly place the mixture being used.

TP6-4. CEMENT. - a. General. - Bulk cement or cement in cloth or paper bags shall be used for all this work, except that cement necessary for grouting, finishing and patching purposes may be packaged.

b. Portland Cement. - Portland cement shall conform to Federal Specification SS-C-192, Type I or Type II.

c. High-Early-Strength Portland Cement. - High-early-strength Portland cement shall conform to Federal Specification SS-C-192 Type III and shall be used only when specifically approved in writing by the Contracting Officer. Concrete made with such cement shall be subject to all applicable provisions of these specifications.

d. Special Test Requirements. - Cement will be sampled at the mill and/or at the site of the work. All tests will be made by, or under the supervision of the Government and at its expense. No cement shall be used until notice has been given by the Contracting Officer that the test results are satisfactory. If tests prove that a cement which has been delivered is unsatisfactory, it shall be promptly removed from the site of work.

e. Storage. - Immediately upon receipt at the site of the work, cement shall be stored in a dry, weather-tight and properly ventilated structure with adequate provisions for the prevention of absorption of moisture. All storage facilities shall be subject to the approval of the Contracting Officer. In order that cement may not become unduly aged after delivery, the Contractor shall use any cement which has been stored at the site for 60 days or more before using cement of lesser age. Any cement stored at project site over four (4) months shall not be used unless retest proves it to be satisfactory.

TP6-5. FINE AGGREGATE. - a. Composition. - Fine aggregate shall consist of natural sand, manufactured sand, or a combination of natural and manufactured sands. If the fine aggregate is a combination of separately processed sizes, or a combination of natural and manufactured sands, the different components shall be batched separately or, subject to the written approval of the Contracting Officer, blended prior to delivery to the batching plant.

b. Quality. - Fine aggregate shall consist of hard, tough, durable, uncoated particles. The equipment and plant used in the production of the fine aggregate shall be designed for the production of aggregate conforming with the requirements of these specifications. The stipulated percentages of fines in the sand shall be obtained either by the processing of natural sand or by the production of a suitably graded manufactured sand. If manufactured sand is used, it shall be produced with equipment designed for producing this type of sand. The shape of the particles shall be generally rounded or cubical and reasonably free from flat or elongated pieces. Rock which breaks down into thin, flat, elongated particles, regardless of the type of processing equipment used, will not be approved for use in the production of fine aggregate. A thin, flat, elongated particle is defined as a particle having a maximum dimension in excess of five times the minimum dimension. The fine aggregate shall conform to the following specific requirements:

(1) Grading. - Fine aggregate shall be well graded from fine to coarse, and the gradation shall conform to the following requirements as delivered to the mixers or as incorporated in the mixed concrete:

Sieve Designation U.S. Std. Square Mesh	Cumulative Percentage by Weight Passing	Retained
No. 4	95-100	0-5
No. 8	80-90	10-20
No. 16	55-75	25-45
No. 30	30-60	40-70
No. 50	12-30	70-88
No. 100	3.5-10	90-96.5

In addition to the grading limits shown above, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.40 or more than 2.90 and, during normal operations, the grading of the fine aggregate shall be controlled so that the fineness moduli of at least nine of ten test samples of the fine aggregate as delivered to the mixer shall not vary more than 0.10 from the average fineness modulus. The fineness modulus shall be determined by dividing by 100 the sum of the cumulative percentages retained on U. S. Standard Sieves Nos. 4, 8, 16, 30, 50 and 100. Any washing, screening, classifying, blending, batching or other operations on the sand required to meet this specification shall be done by the Contractor, and the cost thereof shall be included in the contract unit price for the items of work in which the fine aggregate is used. At the option of the Contractor, fine aggregate may be separated into two or more sizes or classifications, but the resulting combined sand shall be of uniform grading within the limits specified above.

(2) Soundness. - Suitable tests and the service record will be used to determine the acceptability of the fine aggregate. In the event suitable tests and a service record that are satisfactory to the Contracting Officer are not available, as in the case of newly operated sources, the fine aggregate shall be subjected to such tests as are necessary to determine its acceptability for use in concrete for the proposed structures. The tests to which the aggregate will be subjected will include specific gravity, absorption, soundness in magnesium sulfate, petrographic analyses, freezing and thawing in concrete, alkali-aggregate reaction, and any other tests that are necessary to demonstrate that concrete of acceptable durability over a long period of years can be produced.

(3) Sampling. - All sampling of fine aggregate shall be in accordance with the applicable portions of Federal Specification SS-A-281a, or as directed by the Contracting Officer. The source from which fine aggregate is to be obtained shall be selected well in advance of the time when the material will be required in the work. Samples of the fine aggregate, suitable to the Contracting Officer, shall be furnished at a point designated by the Contracting Officer at least thirty (30) days in advance of the time when the placing of concrete is expected to begin. Unless otherwise specified, all test samples shall be taken under the supervision of the Contracting Officer and delivered to the designated point by the Contractor at his expense. All tests will be made by, and under the supervision of the Government at its expense. Routine control tests and analyses of the fine aggregate at various stages in the processing operations will be made by the Government. The Contractor shall provide such facilities as the Contracting Officer may consider necessary for the ready procurement of representative test samples.

c. Storage. - Fine aggregate shall be stored in such a manner as to avoid the inclusion of any foreign materials in the concrete. The storage piles shall be constructed so as to prevent segregation. The deposition of the material in storage and its removal therefrom shall be done in such a manner as to result in increasing the uniformity of the grading insofar as is practicable. All fine aggregate shall remain in free draining storage for at least seventy-two (72) hours prior to use. Sufficient live storage shall be maintained at all times to permit continuous placement of concrete at the rate specified in Paragraph TP6-10.

TP6-6. COARSE AGGREGATE. - a. Composition. - Coarse aggregate shall consist of gravel, crushed gravel or stone or a combination thereof.

b. Quality. - Coarse aggregate shall consist of hard, tough, durable and uncoated particles. The equipment and plant used in the production of coarse aggregate shall be designed for the production of aggregate conforming with the requirements of these specifications. When crushed aggregate is furnished, the dust shall be removed by adequate washing. The particle shape of the smallest size of crushed coarse aggregate shall be generally rounded or cubical, and the tolerance on flat and elongated particles in all sizes of the coarse aggregate shall be

governed by the inherent placeability requirements of the structure in which the mixture is to be placed. A thin, flat and elongated particle is defined as a particle having a maximum dimension greater than five times the minimum dimension. Aggregate which has disintegrated or weathered badly, under exposure conditions similar to those which will be encountered by the structures under consideration, shall not be used. The coarse aggregate shall conform to the following specific requirements:

(1) Grading. - The coarse aggregate shall be well graded from fine to coarse. It shall be separated into the following specific size groups or on other sieves common to local practice which will provide the required number of separations and adequate control of the grading. The grading of the aggregate within the separated size groups shall be as follows:

Sieve Size U.S. Std. Sq. Mesh	Per Cent by Weight Passing Individual Sieves			
	No. 4 to 3/4"	3/4" to 1½"	1½" to 3"	3" to 6"
7"				100
6"				90-100
3"			90-100	0-15
2"			20-55	0-5
1½"		90-100	0-10	
1"		20-45	0-5	
3/4"	90-100	0-10		
3/8"	30-55	0-5		
No. 4	0-5			

The sizes of coarse aggregate to be used in the various parts of the work shall be in accordance with the following or as directed by the Contracting Officer.

LOCATION	DESIGNATED LARGEST SIZE
Item 8	1-1/2
Item 9	1-1/2

(2) Soundness. - Suitable tests and the service record will be used to determine the acceptability of the coarse aggregate. In the event suitable tests and a service record that are satisfactory to the Contracting Officer are not available, as in the case of newly operated sources, the coarse aggregate shall be subjected to such tests

as are necessary to determine its acceptability for use in concrete for the proposed structures. The tests to which the aggregate will be subjected will include specific gravity, absorption, Los Angeles Abrasion, soundness in magnesium sulfate, petrographic analyses, freezing and thawing in concrete, alkali-aggregate reaction, and any other tests that are necessary to demonstrate that concrete of acceptable durability over a long period of years can be produced.

(3) Sampling. - All sampling of coarse aggregate shall be in accordance with Federal Specification SS-A-281a, or as directed by the Contracting Officer. The source from which coarse aggregate is to be obtained shall be selected well in advance of the time when the material will be required in the work. Adequate samples of coarse aggregate for all required tests shall be furnished at a point designated by the Contracting Officer at least thirty (30) days in advance of the time when the placing of the concrete is expected to begin. Unless otherwise specified, all test samples shall be taken under the supervision of the Contracting Officer and delivered to the designated point by the Contractor at his expense. All tests will be made by, and under the supervision of the Government at its expense. Routine control tests and analyses of the coarse aggregate at various stages in the processing operation will be made by the Government, and the Contractor shall provide such facilities as the Contracting Officer may consider necessary for the ready procurement of representative test samples.

c. Storage. - Coarse aggregate storage piles shall be built in such a manner as to avoid the inclusion of any foreign material in the concrete and to prevent segregation and excessive breakage. Sufficient live storage shall be maintained at all times to permit continuous placement of concrete at the rate specified in Paragraph TP6-10.

TP6-7. WATER. - Water used in mixing concrete shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter.

TP6-8. PROPORTIONING OF CONCRETE. - a. Control. - The proportion of all material entering into the concrete shall be as directed by the Contracting Officer. The Contractor shall provide all necessary equipment and plant to determine and control the actual amounts of material entering each batch. The proportions will be changed whenever, in the opinion of the Contracting Officer, such change is necessary in order to maintain the standard of quality required by these specifications.

b. Measurements. - All materials entering into the concrete shall be mechanically batched and measured by weight. One bag of cement will be considered as ninety-four (94) pounds in weight and one gallon of water as 8.33 pounds.

c. Cement Content. - The cement content in the various schedule items of concrete will range from an approximate minimum of 4 to an approximate maximum of 5 bags per cubic yard, depending on the size, type and gradation of aggregate used, and on the structural requirements as determined by the Contracting Officer.

d. Aggregate Content. - Concrete mixes will be designed to use the largest size and the maximum amount of coarse aggregate available and placeable in the various parts of the structures, and the aggregate plant will be designed on this basis.

e. Placeability. - The concrete mixtures which have been designed and tested in the laboratory will be adjusted in the field from

time to time to meet the varying conditions encountered during construction. Unless otherwise provided, the concrete shall be so controlled that the slump at all times is kept between one and one-half (1-1/2) inches and three (3) inches when tested in accordance with A.S.T.M. Designation C-143-39.

TP6-9. CINDER CONCRETE. - a. Where concrete is indicated as filler in the roof of the pumping station, it shall be mixed in the approximate proportion of 1 bag of cement to 2 cubic feet of sand and 4 cubic feet of cinders, mixed as required by the Contracting Officer. Test blocks of concrete shall be made by the Contractor at no expense to the Government, before the concrete is placed, to determine the correct proportions of the ingredients to obtain a cinder concrete of proper qualities for nailing and permanently supporting the roof surfacing. The cement and sand shall conform to the requirements for regular concrete specified herein. The cinders shall be coarse, clean and free from dust. The top surface of the concrete shall be given a smooth and even finish, and shall have a uniform slope to the scuppers.

b. If so elected by the Contractor and approved by the Contracting Officer, a substitute for cinders may be used. Any such substitute must be a commercial product of proven quality, prepared especially as a roof filler. When mixed and used as recommended by the manufacturer, the resulting product must have strength and nailing properties equivalent to that of cinder concrete, and its unit weight shall not be in excess of that of cinder concrete of equivalent quality.

c. Payment for cinder concrete including cement will be included in the payment for Item 11, "Pumping Station Superstructure" (see Paragraph TP7-10).

TP6-10. BATCHING AND MIXING. - a. Equipment. - The Contractor shall provide at the site of the work a modern and dependable batch-type mixing plant with a minimum capacity of 100 cubic yards of concrete in eight (8) hours. The equipment shall be capable of combining the aggregate, cement and water into a uniform mixture within the time limit specified and of discharging this mixture without segregation. Adequate facilities shall be provided for accurate measurement and control of each of the materials entering the concrete. Any waste resulting from faulty operation of batching equipment, over-batching of materials, or other causes will be charged to the Contractor. The complete plant assembly shall include provisions to facilitate the inspection of all operations at all times. All records and charts of the batching and mixing operation shall be prepared as required herein and shall become the property of the Government. The plant shall be subject to the approval of the Contracting Officer and shall conform to the following detailed requirements:

(1) The accuracy of the weighing equipment shall conform to the applicable requirements of Federal Specification AAA-S-121b for such equipment. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring device. Periodic tests shall

be made in the presence of a Government inspector, in such a manner and at such intervals as may be directed by the Contracting Officer. Upon completion of each check test, and before further use of the measuring or recording devices, the Contractor shall make such adjustments, repairs or replacements as may be required to secure satisfactory performance.

(2) Delivery of materials from the batching equipment shall be within the following limits of accuracy:

Material	Per Cent by Weight
Cement	1
Water	1
Aggregate smaller than 1-1/2" size	2
Aggregate larger than 1-1/2" size	3

The batchers shall be arranged to permit the convenient addition or removal of material. Batching equipment shall be so constructed and arranged that the sequence and time of discharge can be controlled to produce a ribboning and mixing of the aggregate and, wherever practicable, of the cement with the aggregate as the materials pass through the charging hopper into the mixer. This control shall be effected by the control of the batcher discharge gates.

(3) Each weighing unit shall include a visible, springless dial or equally suitable device which shall indicate the scale load at all stages of the weighing operation from zero to full capacity.

(4) In so far as practicable, the dial shall be in full view of the operator, and the weighing equipment shall be arranged so that the operator may conveniently observe the operation of the batcher gates and the discharge of the materials.

(5) There shall be provided an automatically printed record of the quantity of cement discharged from the batchers for each batch of concrete. The weight of the cement charged shall be recorded in pounds; the recorder shall be continuous and each batch shall be recorded separately. The interconnecting mechanism from the batcher to the recorder shall be locked and the key therefor turned over to the Contracting Officer.

(6) The batching plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregate and to change the weights of the materials being batched.

(7) The mechanism for delivering water to the mixers shall be such that leakage will not occur when the valves are closed. The filling and discharge valves for the water tank shall be so interlocked that the discharge valves cannot be opened before the filling valve is fully closed.

(8) The plant shall include a device for indicating and recording the number of batches mixed.

(9) Suitable facilities shall be provided for readily obtaining representative samples of aggregate from each of the batchers for test purposes.

(10) The mixing plant shall be equipped with suitable devices for obtaining representative samples of concrete for slump, unit weight and uniformity tests. All necessary platforms, tools and equipment for obtaining samples shall be furnished by the Contractor. Concrete specimens will be prepared from the mixtures used in the work and tested to determine the adequacy and accuracy of control of the materials entering into the concrete mix. Preparation, storage and testing of the specimens will be at the expense of the Government.

(11) There shall be provided on each mixer an acceptable device to lock the discharge mechanism until the required mixing time has elapsed.

b. Mixing Time. - The mixing time for each batch, after all solid materials are in the mixer drum, provided that all the mixing water shall be introduced before one-fourth (1/4) of the mixing time has elapsed, shall be as follows:

Capacity of Mixer	Mixing Time
1/2 cubic yard, or smaller	1-1/4 minutes
3/4 to 1-1/2 cubic yards, incl.	1-1/2 minutes
2 and 3 cubic yards	2 minutes
4 cubic yards	2-1/2 minutes

The mixing periods specified are predicated on proper control of the speed of rotation of the mixer and of the introduction of the materials, including water, into the mixer. The mixing time may be increased when, in the opinion of the Contracting Officer, the charging and mixing operations fail to result in the required uniformity of composition and consistency of the concrete or when test samples of concrete taken from three locations, such as front, center and back of the mixer, show a difference of more than ten (10) per cent in the sand-cement or water-cement ratios. The mixer shall revolve at a uniform speed for a minimum of twelve (12) revolutions after all materials have been placed in it. Mixers shall not be charged in excess of the capacity recommended by the manufacturer, nor shall they be operated at a speed in excess of that recommended by the manufacturer. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted. Should any mixer at any time produce unsatisfactory results, as determined by the Contracting Officer, its use shall be promptly discontinued until it is repaired or replaced.

c. Special Equipment. - The use of transit, truck, or agitator-mixed concrete is authorized. The equipment and methods to be used shall be approved by the Contracting Officer in writing. Concrete, so manufactured, shall comply in every respect with these specifications.

The Contracting Officer may, at any time, reduce the size of batches, adjust batching sequences, mixing time or mixing speed, and make such changes as are deemed necessary to obtain concrete of the quality herein specified. Weighing and batching equipment shall conform specifically to requirements of Paragraphs TP6-10a, -10a(1), (2), (3), (4), (6), (7) and (8), and except as covered therein, the use of such equipment for mixing and transporting concrete shall be in accordance with applicable portions of A.S.T.M. Designation C 94-44.

TP6-11. CONVEYING. - Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. There shall be no vertical drop greater than five (5) feet except where suitable equipment is provided to prevent segregation and where specifically authorized by the Contracting Officer. Belt conveyors, chutes or other similar equipment in which the concrete is delivered to the structure in a thin, continuously exposed flow will not be permitted except for very limited or isolated sections of the work, and only then if approved in writing by the Contracting Officer. Such equipment shall be arranged to prevent objectionable segregation.

TP6-12. PLACING. - a. General. - Concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around all reinforcement and embedded items without permitting the material to segregate. Concrete shall be deposited as close as possible to its final position in the forms so that flow within the mass and consequent segregation are reduced to a minimum. Placing of concrete shall, as far as practicable, be done by means of bottom-dump buckets of sufficient size to handle the full capacity of one mixer but not to exceed four (4) cubic yards capacity. The design of the buckets shall permit close regulation of the amount of concrete to be deposited in each dumping position. It is contemplated that the full capacity of a bucket may be deposited in one operation, but near forms or embedded items or elsewhere as directed by the Contracting Officer, the discharge shall be controlled so that the concrete may be effectively compacted into horizontal layers not exceeding eighteen (18) inches in thickness with a minimum of lateral movement and accompanying tendency for segregation and the formation of rock pockets. Free water shall be collected in depressions away from the forms and removed by bailing prior to placement of additional concrete. All concrete placing equipment and methods shall be subject to the approval of the Contracting Officer.

b. Time Interval between Mixing and Placing. - Concrete shall be placed before initial set has occurred and, unless otherwise authorized by the Contracting Officer, before it has contained its water content for more than forty-five (45) minutes.

c. Placing Temperature. - (1) Cold Weather. - Concrete shall not be placed when the ambient temperature is below thirty-five (35) degrees F. unless specifically approved, nor when the concrete, without special protection, is likely to be subjected to freezing temperatures before final set has occurred. If concrete is placed when the temperature is below thirty-five (35) degrees F., such placement will be

directed by the Contracting Officer in writing, and the materials shall be heated in such a manner that they will be free of ice, snow and frozen lumps before entering the mixer. All methods and equipment for heating shall be subject to the approval of the Contracting Officer. Concrete, when deposited in the forms during cold weather, shall have a temperature of not less than forty (40) degrees F., nor more than sixty (60) degrees F., and shall, at all times, be delivered to the forms at the coolest temperature within the range specified which it is practicable to produce under the current conditions.

(2) Warm Weather. - All concrete shall be delivered to the forms at all times at the coolest temperature which it is practicable to produce under current conditions. Concrete placement will not be permitted when, in the opinion of the Contracting Officer, the sun, heat, wind or humidity prevents proper placement and consolidation.

d. Concrete on Earth Foundations. - Unless otherwise authorized, all concrete shall be placed upon clean, damp surfaces free from frost, ice, standing or running water, and never upon soft mud, dried, porous earth, or upon fills that have not been subjected to approved rolling and tamping until optimum compaction has been obtained. The Contractor shall take all measures necessary to accomplish the results contemplated in this paragraph.

e. Vertical Joint Spacing. - The layout of all monoliths shall be as shown on the drawings or as directed and approved by the Contracting Officer, before construction is commenced.

f. Lift in Concrete. - The permissible depth of concrete placed in one lift or course will be determined by the Contracting Officer for each structure. All concrete shall be deposited in approximately horizontal layers not to exceed eighteen (18) inches in thickness unless otherwise specifically authorized or directed by the Contracting Officer. The placement shall be carried on at such a rate that all concrete surfaces not yet to grade shall not have reached their initial set before additional concrete is placed thereon. Slabs shall generally be placed in one course unless the depth is so great that this procedure will produce objectionable results. In walls of building, courses including openings shall terminate at the top and bottom of the openings, and other courses shall terminate at such levels as will conform to architectural details.

g. Vibration of Concrete. - Concrete shall be placed with the aid of mechanical vibrating equipment and supplemented by hand-spading and tamping. In no case shall vibrators be used to transport concrete inside the forms. The vibrating equipment shall be of the internal type, and shall at all times be adequate in number of units and power of each unit to properly consolidate all concrete. Form or surface vibrators shall not be used unless specifically approved by the Contracting Officer. Internal vibrators shall maintain a speed of not less than 6,000 impulses per minute when in operation submerged in the concrete. The intensity (amplitude) of vibration shall be sufficient to produce satisfactory consolidation. The duration of vibration shall be limited to that necessary to produce satisfactory consolidation without

causing objectionable segregation. Insertion of the vibrator into lower courses that have commenced initial set or the disturbance of reinforcement embedded in concrete beginning to or already set shall be avoided. Where absorptive form lining is used, the vibrator shall not be placed between the forms and the outer row of reinforcement, and in no case shall the vibrator be allowed to come in contact with the absorptive form lining.

h. Finishing of Concrete Lift Surfaces. - The manipulation of the concrete adjacent to the surface of the lift in connection with completing lift placement shall be the minimum necessary to produce not only the degree of consolidation desired in the surface layer of concrete, but also a surface with the desired degree of roughness for bond with the next lift. Surface vibration or excessive surface working, including screeding of any kind, will not be permitted. All top surfaces not covered by forms, and which are not to be covered by additional concrete or backfill, shall be carried slightly above grade, as directed by the Contracting Officer, and struck off by board finish.

i. Placing Concrete through Reinforcement. - In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. On the bottom of beams and slabs, where the congestion of steel near the forms makes placing difficult, a layer of mortar of the same cement-sand ratio as used in the concrete shall be first deposited to cover the surface to the extent directed by the Contracting Officer.

TP6-13. CONSTRUCTION JOINTS. - a. General. - After the top surface of a lift is finally compacted, it shall be immediately and carefully protected, for periods as determined by the Contracting Officer, from direct rays of the sun, pedestrian traffic, materials being placed thereon, running water, heavy rain, or any activity upon the surface that in any manner will affect the setting of the concrete. Vertical and horizontal joints on exposed faces shall be chamfered or formed to produce a uniform and neat appearance as indicated on the contract drawings or as directed by the Contracting Officer.

b. Cleaning. - Horizontal construction joints on lifts with relatively open and accessible surfaces may be prepared for receiving the next lift by either wet sandblasting or cutting with an air-water jet, as specified below. However, approved wet sandblasting equipment shall be provided. If the surface of a lift is congested with reinforcing steel, is relatively inaccessible, or if for any other reason the Contracting Officer considers it undesirable to disturb the surface of a lift before final set has taken place, surface cutting by means of air-water jets will not be permitted, and the use of wet sandblasting will be required. All excess water shall be removed from the surface of construction joints before the new concrete is placed thereon. After surfaces have been prepared to the satisfaction of the Contracting Officer, all approximately horizontal surfaces shall be covered by a layer of mortar of the same sand-cement ratio as the concrete. Concrete shall then be placed immediately upon the fresh mortar.

(1) Air-Water Cutting. - Air-water cutting of a construction joint shall be performed at the proper time after initial set has taken place but before the concrete has obtained its final set. The surface shall be cut with a high-pressure air-water jet to remove all laitance and to expose clean, sound aggregate, but not so as to undercut the edges of the larger particles of aggregate. The air pressure used in the jet shall be one hundred (100) pounds plus or minus five (5) pounds, and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. The surface shall again be washed with an air-water jet just prior to placing the succeeding lift. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, wet sandblasting may be required immediately before placing the next lift to supplement air-water cutting.

(2) Wet Sandblasting. - When employed in the preparation of construction joints, wet sandblasting shall be performed immediately before placing the following lift. The operation shall be continued until all unsatisfactory concrete and all laitance, coatings, stains, debris, and other foreign materials are removed. The surface of the concrete shall then be washed thoroughly to remove all loose material.

(3) Waste Disposal. - The method used in disposing of waste water employed in cutting, washing and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor or affect exposed surfaces of the structures. Methods of disposal will be subject to the approval of the Contracting Officer.

TP6-14. FINISHING. - a. General. - Immediately after removal of forms or absorptive form lining, all unsightly ridges or lips shall be removed, and undesirable local bulging on the surfaces shall be remedied. Excessive rubbing of formed surfaces will not be permitted. All voids and holes left by the removal of tie rods shall be reamed and neatly filled with dry-patching mortar (pre-shrunk) mixed in the proportions directed by the Contracting Officer. The cement used in the mortar shall be a blend of Portland Cement and White Portland Cement, properly proportioned so that the final color of the cured mortar will be the same as the color of the surrounding concrete. Defective concrete shall be repaired by cutting out the unsatisfactory material and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely in place. Concrete for patching shall be drier than the usual mixture and shall be thoroughly tamped into place. All finishing, filling of voids and tie-rod holes, and patching of exposed surfaces shall be performed immediately after the forms are removed, unless otherwise authorized or directed by the Contracting Officer. All unformed surfaces of concrete that are not to be covered by additional concrete or backfill shall have a wood float finish without additional mortar, and shall be true to elevation as shown on the drawings. Care shall be taken to see that all excess water is removed before making any finish. Other surfaces shall be brought to the specified finished elevation and left true and regular. Where indicated on the drawings, joints shall be carefully made with a jointing tool. Every precaution shall be taken by

the Contractor to protect finished surfaces from stains or abrasions. Surfaces or edges likely to be injured during the construction period shall be properly protected.

b. Floor Surfaces. - The engine room and intermediate floors shall be finished with a one (1) inch monolithic sand-cement mortar surface. All water, laitance, and any foreign matter shall be removed from surfaces. The topping mixture shall be spread evenly over all the base within forty-five (45) minutes after the base has been placed. The mortar shall be of one (1) part cement and two (2) parts approved clean, coarse sand. The cement and sand shall be thoroughly mixed dry, and then sufficient water shall be added to produce a medium stiff mortar. After placing, the mortar shall be floated to a true, regular surface with a wood float and steel-troweled to a smooth finish. Troweling shall be the minimum amount consistent with maintaining a smooth, dense surface, and shall not be done until the mortar has hardened sufficiently to prevent excess fine material from being worked to the surface.

TP6-15. CURING AND PROTECTION. - a. General. - All concrete shall be cured for a period of not less than fourteen (14) consecutive days by an approved method or combination of methods applicable to local conditions, except that the curing period may be reduced to seven (7) days for concrete made with high-early-strength cement. The Contractor shall have all equipment needed for adequate curing and protection of the concrete on hand and ready to install before actual concrete placement begins. The curing medium used shall be approved in writing by the Contracting Officer, and shall be applied so as to prevent checking and cracking and loss of moisture from all the surfaces of the concrete, immediately after placing. The curing medium shall be maintained so as to prevent detrimental loss of water from the concrete for the duration of the entire curing period. Unhardened concrete shall be protected from heavy rains, flowing water, or the direct rays of the sun. All concrete shall be adequately protected from mechanical injury. No fire or excessive heat shall be permitted near or in direct contact with concrete at any time. All conduits and other formed openings through the concrete shall be closed during the entire curing period and as long thereafter as practicable to prevent circulation of air and resultant checking and drying of the concrete.

b. Cold Weather. - Concrete placed during cold weather shall be kept sufficiently moist at all times during curing period to prevent detrimental loss of water from the concrete. The air in contact with the concrete shall be maintained at temperatures between fifty (50) degrees and seventy (70) degrees F., by suitable covering and heating for at least the first five (5) days, and at a temperature above freezing for the remainder of the specified curing period. The temperature protection equipment and the removal of forms shall be handled in such a manner that the surface concrete will not be subjected to a sudden drop in temperature of more than twenty-five (25) degrees F., as determined by observation of ambient and concrete surface temperatures indicated by suitable thermometers, furnished by the Government and installed outside of the concrete and two (2) inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor at his expense and at such locations as may be directed by the Contracting Officer. Salt, chemicals or other materials shall not be mixed with the concrete to prevent freezing.

c. Water Curing. - Concrete, if cured with water, shall be kept wet by covering with an approved, water-saturated material, or by a system of perforated pipes or mechanical sprinklers, or by any other approved method which will keep all surfaces continuously (not periodically) wet. Where forms of tongue-and-groove lagging are used and left in place for curing, they shall be kept wet at all times to prevent opening at the joints and drying out of the concrete. Water for curing shall be generally clean and free from any elements which, in the opinion of the Contracting Officer, might cause objectionable staining or discoloration of the concrete.

d. Saturated Sand Curing. - Horizontal construction joints and finished surfaces cured with sand shall be covered with a minimum thickness of one (1) inch of sand which shall be kept uniformly distributed and continuously saturated during the curing period applicable to the surface being cured.

e. Curing Compounds. - Curing compounds, where used, shall be of the surface membrane type, of composition and characteristics in accordance with Corps of Engineers Guide Specifications, "Specifications for Curing Concrete by Means of Membrane Compounds." The use of curing compounds on any surface shall be subject to the approval of the Contracting Officer. Curing compounds shall not be used on surfaces to which additional concrete is to be bonded. In cold weather, curing compounds shall not be used on concrete surfaces which are maintained at curing temperature by the use of steam pipes. Curing compounds proposed for use on any vertical surface must be specifically approved in writing by the Contracting Officer.

TP6-16. FORMS. - a. Material. - Forms shall be of wood, steel, or other approved material, except that sheeting for all exposed surfaces, where absorptive form lining is not specified or otherwise authorized, shall be tongue-and-groove lumber of uniform width. Form lining having a glazed, water-tight surface will not be permitted for exposed concrete surfaces or for surfaces where severe weathering or severe hydraulic cavitation or erosion may be experienced. The type, shape, size, quality and strength of all materials of which the forms are made shall be subject to the approval of the Contracting Officer.

b. Construction. - Forms shall be true to line and grade, mortar-tight and sufficiently rigid to prevent objectionable deformation under load. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar. Responsibility for their adequacy shall rest with the Contractor. The form surfaces shall be smooth, free from irregularities, dents, sags or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged that when the forms are removed, all metal will be not less than two (2) inches from any concrete surface. Wire ties will not be permitted where the concrete surface will be exposed to weathering and where discoloration will be objectionable. All forms shall be so constructed that they can be removed without hammering or prying against the concrete. All exposed

joints shall be chamfered, and suitable moulding shall be placed to bevel or round exposed edges or corners, including the use of dummy chamfers and false joints to provide a neat and uniform appearance, unless otherwise indicated on the drawings or directed by the Contracting Officer.

c. Coating. - Forms for exposed surfaces, except those lined with absorptive form lining, shall be coated with non-staining mineral oil which shall be applied shortly before the concrete is placed. After oiling, surplus oil on the form surfaces and any oil on the reinforcing steel or other surfaces requiring bond with the concrete shall be removed. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather oil shall be used.

d. Removal. - Forms shall not be removed without the approval of the Contracting Officer, and all removal shall be accomplished in a manner which will prevent injury to the concrete. When forms are removed under conditions of a wide differential of temperature between the concrete and the atmosphere, provision, satisfactory to the Contracting Officer, shall be made for maintaining a blanket of moist air adjacent to the concrete and thus gradually reducing the temperature differential between the concrete and the surrounding atmosphere. A temperature differential of less than twenty-five (25) degrees F. will be required. (This differential will be determined as in Paragraph TP6-15b.) Forms shall not be removed before the expiration of the minimum time indicated below, except as otherwise directed or specifically authorized by the Contracting Officer.

Arches, Beams and Slabs	10 days
Columns	5 days
Walls and Vertical Faces	2 days

When, in the opinion of the Contracting Officer, conditions on the work are such as to justify the requirement, forms may be required to remain in place for longer periods or the above time limits modified where conditions fully justify such modification.

e. Absorptive Form Lining. - (1) Quality. - The forms for exposed interior and exterior surfaces of walls, ceiling and beams of the engine room and the interior walls, ceiling and beams of the pump room, boiler room and screening room shall be lined with an absorptive form lining of approved quality. The form lining shall remain in place after removal of the forms to provide a blanket of moisture on the surface, and to serve as a protection for the concrete surface against staining or abrasion during the curing period. The form lining shall be highly absorptive to air and water, and shall be readily and completely removable from the concrete surface at the end of the curing period. The form lining shall, through its absorptive capacity, eliminate voids, pits and other common defects of the surface of the concrete placed against it, and shall produce a dense concrete surface of texture satisfactory to the Contracting Officer. The lining shall be easily cut and fitted, and shall be readily adaptable to any other operation necessary

to its use. The lining itself and any treatment employed in its manufacture shall not discolor the concrete or interfere with the normal chemical reaction of the cement in the concrete.

(2) Tests. - The type of lining used shall be subject to the approval of the Contracting Officer. Tests shall be made by the Contractor of all proposed absorptive lining as directed by the Contracting Officer. These tests shall include the use of absorptive form lining on concrete surfaces which will later be covered with backfill. Samples shall also be furnished to the Government for laboratory tests for any type of lining having no previous service record before such lining will be approved.

(3) Installation. - Absorptive form lining shall be attached to the forms in such a manner as to hold the lining snugly in contact with the surface of the forms, free from bulging and other imperfections that might cause unevenness or roughness of the concrete surface. Nails, tacks or staples, if used, shall be driven in a uniform pattern and shall be flush with the surface of the absorptive form lining. Care shall be taken not to make dents in the surface of the lining with the hammer or in any other manner. After the absorptive form lining has been attached to the form, the joints shall be rubbed with a smooth tool to press down any projecting material. The locations and directions of joints in absorptive form lining shall be as directed or approved by the Contracting Officer. For cutting and trimming the absorptive lining, the Contractor shall use tools which are well adapted to this type of work and are maintained in such condition that smooth edges will be produced. The joints between the sheets of absorptive form lining shall be finished smoothly and accurately, and patching of the sheets will not be permitted. At joints, the edges of the form lining shall be in contact but shall not be pressed tightly together. The Contractor shall avoid splashing mortar or concrete on the absorptive lining, and shall replace sheets of lining which have been damaged. Absorptive form lining shall be used only once and after being used shall be removed from the site. At all times subsequent to the delivery of the form lining and prior to placing the concrete against the lining, the Contractor shall take all precautions necessary to protect the lining from becoming damp or wet to such an extent as to reduce its effectiveness as an absorptive medium. Particular care shall be exercised to protect absorptive form lining during clean-up operations, and temporary protection of such linings will be required. The use of absorptive form lining which has become wet or which contains visible external defects such as holes, ragged or untrue edges, breaks, cracks, tears, protuberances or indentations will not be permitted.

TP6-17. EXPANSION AND CONTRACTION JOINTS. - a. General. - Expansion and contraction joints shall be constructed at such points and of such dimensions as are indicated on the drawings or as required by the Contracting Officer. The method and materials used shall be subject to the approval of the Contracting Officer, and the materials shall conform to Federal Specifications wherever applicable. In no case shall corner protection angles or other fixed metal, embedded in and bonded to the surface of the concrete, be continuous through an expansion.

b. Expansion Joint Filler. - Where indicated on the drawing, or otherwise required by the Contracting Officer, the expansion joints shall be made by trowelling on the surface the required thickness of bituminous cement containing asbestos fibre or by installing premolded asphaltic joint filler or cork filler of approved quality. Bituminous cement shall be placed at least twenty-four (24) hours prior to the placement of the adjacent concrete unless otherwise approved by the Contracting Officer.

c. Copper Water Stops. - Copper water stops 8 inches wide, 20 ounces per square foot, shall be installed at the box forms for the intake and discharge wall castings (see Paragraphs TP16-5b and c) as directed by the Contracting Officer. The Contractor shall replace or repair, at his own expense, any water stops punctured or damaged before final acceptance of the work.

TP6-18. STEEL REINFORCEMENT. - a. General. - The Contractor shall cut, bend and place, in accordance with the drawings prepared by the Contractor and approved by the Contracting Officer, all steel reinforcement including rods, fabric and structural shapes. All reinforcement shall be, when surrounding concrete is placed, reasonably free from loose, flaky rust and scale, and free from oil, grease or other coating which might destroy or reduce its bond with the concrete. The Contractor shall furnish drawings showing bending details and placing schedules of all steel reinforcement, for approval by the Contracting Officer.

b. Cutting and Bending. - Steel reinforcement may be mill or field bent. All bending shall be in accordance with standard approved practice and by approved machine methods.

c. Quality. - The steel reinforcement shall conform to the requirements of Paragraph TP8-2a(24).

d. Spacing of Bars. - The spacing of bars shall be as shown on the contract drawings or as directed by the Contracting Officer.

e. Relation of Bars to Concrete Surfaces. - The minimum cover for all main reinforcement shall conform to the dimensions shown on the drawings. The dimensions, as shown on the drawings, will indicate the clear distance from the edge of the main reinforcement to the concrete surface. The concrete covering of stirrups, spacer bars and similar secondary reinforcement may be reduced by the diameter of such bars.

f. Splicing. - All splices in reinforcement shall be as shown on the drawings or as directed by the Contracting Officer. The lapped ends of bars shall be either separated sufficiently to permit the embedment of the entire surface of each bar in concrete or connected as a single, continuous bar to develop the full strength of the bar.

g. Supports. - All reinforcement shall be secured in place by use of metal or concrete supports, spacers or ties, as approved by the

Contracting Officer. Such supports shall be of sufficient strength to maintain the reinforcement in place throughout the concreting operation. The supports shall be used in such manner that they will not be exposed or contribute in any way to the discoloration or deterioration of the concrete.

h. Protection for Future Use. - Exposed reinforcement, intended for bonding to future work, shall be protected from corrosion by heavy wrapping of burlap saturated with a bituminous material. Reinforcement so protected shall be thoroughly cleaned prior to subsequent concrete placing.

TP6-19. EMBEDDED ITEMS. - a. General. - Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings or required by the Contracting Officer. All embedded items shall be thoroughly clean and free of oil and other foreign matter such as loose coatings of rust, paint and scale. The embedding of wood in concrete shall be avoided unless specifically directed or authorized by the Contracting Officer. Metal shall be used instead. Any air or water lines or other materials embedded in structures, as construction expedients authorized by the Contracting Officer, shall conform to the above requirements, and upon completion of their use, shall be backfilled with concrete or grout as directed by the Contracting Officer.

TP6-20. WATERPROOFING. - a. General. - (1) The Contractor shall waterproof (bituminous) the pumping station substructure as shown on the drawings. Waterproofing shall be done by experienced mechanics who are regularly engaged in waterproofing of the type herein specified.

(2) Surfaces to receive membrane waterproofing shall be dry and thoroughly cleaned, and shall be firm, free of holes, pockets, cracks, and sharp edges or projections that might break the fabric. No waterproofing shall be applied when the ambient temperature is lower than forty-five (45) degrees Fahrenheit. Coal-tar-creosote primer and coal-tar pitch shall be used with coal-tar-saturated cotton fabric. Asphalt primer and asphalt pitch shall be used with asphalt-saturated cotton fabric.

b. Type. - Three-ply waterproofing (hot process) consisting of three layers of woven cotton fabric and four moppings of hot pitch shall be used.

c. Materials. - Materials furnished and installed shall be in accordance with the following specifications.

(1) Waterproof paper shall conform to the requirements of Federal Specification UU-P-536, Grade A.

(2) Coal-tar-saturated woven cotton fabric shall conform to the requirements of Federal Specification HH-C-591.

(3) Asphalt-saturated woven cotton fabric shall conform to the requirements of Federal Specification HH-C-581a.

(4) Coal-tar-creosote primer shall conform to the requirements of Federal Specification TT-W-560.

(5) Asphalt primer shall conform to the requirements of Federal Specification SS-A-701.

(6) Coal-tar pitch shall conform to the requirements of Federal Specification R-P-381, Type II.

(7) Asphalt pitch shall conform to the requirements of Federal Specification SS-A-666, Type III.

d. Preparation. - Concrete surfaces to receive membrane waterproofing shall be brush-coated with primer, using not less than one (1) gallon per one hundred (100) square feet. The primer coat shall be allowed to dry for at least thirty-six (36) hours before applying the waterproofing.

e. Application. - The layers of cotton fabric shall be lapped so that the number of plies specified will be the minimum at every point of the surface to be waterproofed. Each layer of cotton fabric shall be rolled into place, and shall be completely bedded to eliminate air pockets and wrinkles. Each layer of cotton fabric shall be well lapped in the direction of the water flow, with side laps not less than seventeen (17) inches, end laps not less than six (6) inches, and with all cross joints broken in adjacent courses. Side laps of cotton fabric laid in single layers shall be not less than eight (8) inches. At angles, corners, returns and around pipes and openings, the waterproofing shall be lapped twelve (12) inches over the adjacent waterproofing, and in addition shall be reinforced on both sides with two (2) layers of cotton fabric extending at least twelve (12) inches from the intersection. Primer and pitch shall be heated to flow freely, but not above 375 degrees Fahrenheit, and shall be mopped on in uniform coats. The quantities herein specified per square shall be the minimum required to cover one hundred (100) square feet of surface.

f. Pargeting. - The membrane waterproofing shall be protected on the outside by a one (1) inch thickness of pargeting composed of one (1) part Portland cement and two (2) parts sand, applied in two (2) coats, each one-half (1/2) inch thick. The first coat shall be wetted down, if so directed, before the second coat is applied. Care shall be taken in applying the pargeting so that the membrane waterproofing will not be displaced or damaged in any manner.

TP6-21. INSTALLATION OF TEST APPARATUS. - The Contracting Officer reserves the right to install pressure cells, stress meters, thermometers and other test apparatus in the foundations and in various parts of the structures for the purpose of making physical measurements and observations. All technical labor, materials, equipment and supplies for this purpose will be furnished by the Contracting Officer. All common labor, materials, equipment and supplies shall be furnished by the Contractor. Installations by the Contracting Officer will be conducted in such a manner as to offer minimum interference to the operations of the Contractor. The Contractor shall conduct his operations in such a manner as to protect the apparatus from injury or displacement.

TP6-22. MEASUREMENT AND PAYMENT. - a. Concrete. - (1) Measurement of concrete will be made on the basis of the actual volume of concrete within the neat lines of the structures as indicated on the drawings or as otherwise required. Measurement of concrete placed against the sides of any excavation without the use of intervening forms will be made only within the neat lines of the structure. No deductions will be made for rounded or beveled edges or space occupied by metal work, electrical conduits or timber, nor for voids or embedded items which are either less than five (5) cubic feet in volume or one (1) square foot in cross-section. Unless otherwise specified, payment for concrete will be made at the respective contract prices per cubic yard for the various items of the schedule, which price shall include the cost of required unloading, handling and storage at the site of all cement used in the work; of all labor; and of the use of all equipment, tools and materials required to complete the concrete work; except the cement, reinforcement, absorptive form lining and embedded parts which are specified to be paid for separately. No payment will be made for concrete, as such, which is placed in structures for which payment is made as a lump sum.

(2) Payment for expansion joint material shall be included in the contract price for the concrete.

(3) Payment for waterproofing, grouting, pargeting and membrane waterproofing shall be included in the contract price for concrete, except as otherwise specified or indicated on the drawings.

(4) Items for concrete under this contract are as follows:

(a) Item 8, Concrete. - This item includes all concrete placed in the conduits, suction chamber, pumping station substructure and miscellaneous structures as indicated on the drawings. Payment will be made at the contract unit price per cubic yard for Item 8, "Concrete."

(b) Item 9, Concrete. - This item includes all concrete placed in the pumping station base slab, tank foundations and elsewhere as indicated on the drawings. Payment will be made at the contract unit price per cubic yard for Item 9, "Concrete."

b. Portland Cement. - The quantity to be paid for under Item 7, "Portland Cement", will be the number of barrels (376 pounds net weight) of cement actually used in all parts of the work unless specifically excepted, wasted or used for the convenience of the Contractor.

c. Reinforcement. - (1) Measurement of reinforcement will be made of the lengths of bars actually placed in accordance with the drawings or bar schedules approved by the Contracting Officer, or in accordance with the instructions of the Contracting Officer. The measured lengths will be converted to weights for the size of bars listed by the use of the unit weights per lineal foot stated in Federal Specification QQ-B-71a, 1-5. Steel in laps indicated on the drawings or required by the Contracting Officer will be paid for at the contract unit price. No payment will be made for the additional steel in laps

which are authorized for the convenience of the Contractor. Furnishing and placing reinforcement bars, except reinforcement bars in the roof slab of the pumping station superstructure and concrete platform, will be paid for at the contract unit price per pound for Item 10, "Steel Reinforcement." Steel reinforcement in roof slab of the pumping station superstructure and concrete platform will be paid for under Item 11, "Pumping Station Superstructure."

(2) Metal Fabric. - Payment for furnishing and installing metal fabric beam wrapping steel will be included in the contract price for Item 11, "Pumping Station Superstructure."

d. Copper Water Stops. - Payment for furnishing and installing metal water stops will be included in the contract unit price for Item 8, "Concrete."

e. Absorptive Form Lining. - The quantity of absorptive form lining paid for will be determined from the number of square feet of concrete surface actually covered. Payment for any material used in connection with the installation or as a part of the lining shall be included in the contract unit price for Absorptive Form Lining. Payment for furnishing, installing and removing absorptive form lining will be made at the contract unit price per square foot for Item 10A, "Absorptive Form Lining."

SECTION VII. PUMPING STATION SUPERSTRUCTURE (Item 11)

TP7-1. WORK INCLUDED. - a. The Contractor shall construct and complete the pumping station superstructure in accordance with the specifications and the drawings. Item 11 shall include all work incidental to the construction of the pumping station superstructure and other miscellaneous work in the pumping station as shown on the drawings and as specified, except such materials and equipment as are specifically included under other items of the contract. Cement, concrete and reinforcing steel in the substructure will be paid for under Items 7, 8, 9 and 10. The work includes the cement, concrete and reinforcing steel in the roof slab and concrete platform; the structural steel consisting essentially of columns, roof beams, crane beams and crane rails; brick, glass block and cast-stone masonry, window guards, doors, door frames, steel partition, louvers, anchors, builders' hardware, roofing, engine exhaust thimbles and hoods, copper downspouts and cast-iron leader shoes, bronze letters, painting and other work included in the construction of the pumping station superstructure. Doors, frames, sills, metal grille and frame, and hardware below engine room floor, shall also be included under Item 11.

b. The bronze plaque and grille on the west side of the pumping station superstructure will be furnished by the Government and shall be installed by the Contractor, as indicated on the drawings.

TP8-2. STRUCTURAL STEEL. - a. All structural steel shapes, plates, bars, and their products shall conform to the requirements of Federal Specification QQ-S-741, Type I, Grade B. The fabrication and erection of all structural steel shall conform to the requirements of the current American Institute of Steel Construction Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

b. Drawings for approval. - Before commencing fabrication, the Contractor shall submit complete shop details to the Contracting Officer for approval.

TP7-3. BRICK MASONRY. - a. Brick. - All brick shall be whole, sound, straight, hard, uniform in structure, with true, even faces and sharp corners, and shall be uniform in size for their respective kinds. The facing of all exterior walls shall be standard size red shale brick in a full range of color to include reds, browns, hearts, bronzes and blue-blacks. Brick shall be first quality, shall have a matte texture, and shall be similar and equal to brick as manufactured by the following companies: Claycraft Company, Columbus, Ohio, Hydraulic-Press Brick Company, St. Louis, Mo., or Belden Brick Company, Canton, Ohio. The interior face of the exterior walls and the brick for body work shall be best quality common building brick, approximate size 2-1/4 by 3-3/4 by 8 inches, conforming to the requirements of Federal Specification SS-B-656, Class H. The Contractor shall submit to the Contracting Officer, for approval, samples of all brick he proposes to use.

b. Mortar. - Mortar shall be composed of one part waterproof cement (Brixment, or equal), and three parts sand by volume. Mortar shall be thoroughly mixed either by hand or in a mechanical batch mixer, and only in such quantities that it can be used entirely before it has attained its initial set. The use of a continuous mixer or the use of a retempered mortar will not be permitted. The minimum amount of water sufficient to make a workable mortar shall be used. All sand shall conform to the requirements of Paragraph TP6-5 for fine aggregate and shall pass a No. 8 standard sieve. Sand used in mortar for face brick shall be natural white or clean sand approved by the Contracting Officer.

c. Laying brick. - (1) All brick masonry shall be accurately laid in courses as indicated on the drawings. All exposed surfaces shall be laid to lines that are plumb, true, straight, and level. Each brick shall be laid in a full bed of mortar and shall be shoved into place in the mortar, making joints that are full without subsequent slushing or filling. Except where otherwise indicated on the drawings, the brick course including mortar joint shall be 2-5/8 inches high. Vertical and horizontal mortar joints shall have the same thickness. Finish mortar joints for exterior brickwork shall be concave tooled. Mortar joints for interior brickwork shall be struck flush. Except where otherwise indicated, all exposed faces of brickwork shall be laid in common bond, with stretchers bonded every sixth course by a course of headers staggered for exterior and interior faces. Metal wall ties shall not be used for the bonding of brickwork, except where indicated on the drawings or authorized by the Contracting Officer. Care shall be taken to insure the weather-tightness of the brick masonry to its concrete foundation.

(2) The courses shall be laid to correspond exactly in height with the heads of doors and other openings without any cutting or chipping of the brick. Frames, flashing, and all other fixtures shall be built into the brickwork as it is laid. Brick masonry around glass block panels and door openings shall have jambs built true and plumb with the reveals at right angles and of the depth shown on the drawings, and the brickwork shall either be kept back a sufficient distance or raked out to permit a caulked joint as indicated on the drawings. The body brickwork shall be kept level with the facing and each piece of facing material shall be backed up solid with brick and mortar to make a perfectly bonded homogeneous mass between wall lines. All walls shall be carried up together as nearly as possible on the same level. If during construction, the walls become displaced, damaged, or marred by the Contractor or his workmen, the Contractor shall, without additional compensation, execute all patching and repairing necessary to leave the entire work in perfect condition. The placing of put-logs in masonry walls is prohibited. The Contractor shall place boards over all sills and projecting stone or water tables during construction.

(3) Care must be taken that the tops of all unfinished work are thoroughly covered or protected against inclement weather, by means of waterproof canvas and boards. Brick laid in warm weather shall

be kept wet before laying and shall be wet when laid. Bricks laid in cold weather shall be laid dry and warm. In winter the brick, sand, water, and other material shall be kept warm and, if required by the Contracting Officer, shall be heated by approved methods in order that the work shall proceed properly. The brickwork shall be carefully covered and protected to prevent freezing.

(4) The Contractor shall carefully set or build in all door frames, wall plates, anchors, beams, bolts, or other iron work; bronze, or other incidental materials; and shall build all recesses and pipe chases, as indicated on the drawings or directed by the Contracting Officer.

(5) After completion, all brickwork shall be cleaned and pointed where necessary. Before pointing, the joints shall be raked out, 1 inch deep, cleaned and well moistened. The caulking around all doors, louvers and ventilators shall be carefully checked, and the joints recaulked where necessary.

(6) The dimensions of the brickwork shown on the drawings may be varied slightly depending on the size of the brick used.

TP7-4. GLASS BLOCK. - a. Glass block panels shall be installed as shown on the drawings. The glass blocks shall be hollow, partially evacuated, water-clear units of pressed glass construction of the best quality, similar and equal to the units manufactured by the Owens-Illinois Glass Company, Toledo, Ohio, or the Pittsburgh Plate Glass Company, Pittsburgh, Pa. Unless otherwise shown on the drawings, all glass blocks shall have a standard size of 11-3/4 by 11-3/4 by 3-7/8 inches. A sample of the type of glass blocks the Contractor proposes to furnish shall be submitted for the approval of the Contracting Officer, with drawings showing the details of installation in accordance with the standard practice of the manufacturer of the glass blocks.

b. Laying of block. - (1) Each block shall be set in a 1/4-inch bed of mortar as specified for brick (see Paragraph TP7-3 b). The sand used in the mortar shall conform in quality to that specified in Paragraph TP7-3 b for sand used for mortar for face brick. Glass blocks shall be laid true to line and grade. All mortar joints shall be completely filled with mortar; after the mortar has reached its initial set, the joints on both surfaces shall be compressed and pointed with a metal pointing tool, leaving the finished surface of the joint smooth and non-porous. Blocks shall not be cleaned until after mortar has reached its final set.

(2) Horizontal mortar joints shall be reinforced with continuous 20-gage expanded metal wall ties 2-3/8 inches wide or with wire wall ties of approved type and of a length suitable for the glass block panel, hot galvanized after forming. Ties shall run continuously; shall be placed every course, and shall not extend into brick masonry. Wall ties shall not bridge expansion joints.

(3) Expansion joints shall be provided at the head and jambs of all glass block panels, and all joints at head and jamb of panels shall be kept free from mortar and free from transmission of structural loads carried by adjacent masonry. Expansion joints at jambs shall consist of a premoulded waterproof expansion joint filler installed in accordance with the block manufacturer's detailed drawings and as approved by the Contracting Officer. After the glass block panels have been laid and the mortar has set, non-staining oakum shall be caulked between the sides of the block and the sides of the "chase" to form 1/2 inch recess from the jamb surface of the block. The 1/2-inch recess shall be filled flush with the finished surface with non-hardening waterproof caulking material similar and equal to "Vulcatex" manufactured by A. C. Horn Co., Long Island City, N. Y., "Kaukit" manufactured by L. Sonneborn Sons, Inc., New York, N. Y., or other approved elastic (or mastic) compound as shown on the drawings.

TP7-5. CHIMNEY. - The chimney shall be constructed as shown on the drawings, and shall be lined with 8-1/2 inches by 18 inches glazed terra cotta flue lining. The joints shall be well cemented and struck smooth inside. A suitable cast-iron cleanout door and frame of the size indicated on the drawings and required thimble shall be installed in the chimney.

TP7-6. CAST STONE. - a. All stonework shall be of cast stone, light-gray, and shall be placed as indicated on the drawings. The stone shall be uniform in color, sound, and perfect throughout; and subject to inspection before being placed in the work. All exposed surfaces shall have a rubbed finish. The cast stone shall be similar and equal to that made by the Emerson and Norris Company, Boston, Mass., and conform in all respects to Federal Specification SS-S-721, for architectural cast stone, Type 1. The Contractor shall submit samples of the precast stone proposed to be used, for the approval of the Contracting Officer. Samples shall be not less than 8 by 12 inches. The Contractor shall also submit evidence satisfactory to the Contracting Officer that the manufacturer, who will furnish the cast stone, has had at least 10 years of experience in designing and manufacturing cast stone of satisfactory appearance and durability.

b. Before fabricating the stone, the Contractor shall submit, for approval of the Contracting Officer, drawings showing in detail the sizes, coursing, and full details of trim.

c. The casting, sizing, and coursing of all cast stone shall be done in accordance with the approved detail drawings. The stone shall be dressed and finished to a clean, smooth, uniform surface. Washes shall be cast or cut on the tops and drips on the undersides of projections where indicated on the drawings. All arrises shall be sharp and true. Anchors, cuts for accommodating steel work, and other incidental details shall be provided as required. Holes and sinkages shall be cast or cut in stones for all anchors, clamps, dowels, etc. Lewis holes shall be cut or cast in stones weighing more than 100 pounds. Lewis holes or other holes shall be not closer than two

inches to exposed faces of stone, and holes on exposed faces of stone are prohibited. The cast stone shall be made to check with dimensions and all adjoining brickwork.

d. Ornamental panel work shall be cast monolithically. Full size models shall be made by the Contractor and approved by the Contracting Officer before use. Suitable anchors shall be cast in place in each block of ornamental cast stone. All modelled work shall be cut true to detail by experienced stone carvers.

e. Mortar for setting and pointing the cast stone shall be the same as specified for brick and shall match the color of stone (see Paragraph TP7-3 b).

f. Setting stone. - (1) Just before setting, each stone shall be brushed clean and thoroughly drenched with clean water. The stone shall then be accurately set, by competent stone setters, true to line and level, with full flushed joints. Each stone shall rest on a full bed of mortar placed under the center of the stone; the amount of mortar being sufficient to fill all anchor holes and to fill out to the edges of the stone on all sides. All stone shall be set with 1/4-inch joints, raked out at the face to a depth of one inch and left for future pointing. The backs of all stone facings shall be parged with not less than 1/2-inch of setting mortar. Where required in connection with the setting of heavy stones and projecting courses, in order to arrest the squeezing out of mortar beds, tipping off; or uneven setting of the stone; and wherever required in connection with stone bedded on structural members, to prevent cracking or spalling from unequal pressure, the Contractor shall provide and install solid lead pads or buttons of proper thicknesses. All pads or buttons shall be made of solid soft, sheet lead, either round or octagonal in shape, and of the same thickness as finish joints. They shall be set not less than one inch back from the finish face of the stone, and the mortar bed spread around them. Wherever practicable, heavy stones shall be set with derricks and lifted with lewis plugs or hoisting loops. Where lewis plugs or hoisting ropes cannot be used, the stone shall be set with clamps. The use of pinch bars or metal wedges, except on the embedded parts of the stones, is prohibited. No defective or stained stones and no broken, spalled, patched, or otherwise damaged stone shall be used in the work. All rejected material shall be removed promptly from the work area.

(2) The Contractor shall install all necessary anchors and dowels, as indicated on the drawings or as required by the Contracting Officer.

(3) The Contractor shall protect all cast-stone work from damage of every description until all construction work is completed. All damaged work shall be replaced by the Contractor at no additional expense to the Government.

(4) After the stone has been set, all work shall be thoroughly cleaned, and all joints brushed clean, soaked with clean water, filled solid with pointing mortar, and dressed. The use of wire brushes, or acids and solutions which might cause discoloration, will not be permitted in cleaning stone.

(5) The cast stone coping supporting the floodlight shall be four-foot minimum length and shall have 5/8-inch round stainless steel bolts cast integrally with the stone and shall be spaced as required for the floodlight base selected.

TP7-7. DOORS. - a. Doors shall be of the type and design shown on the drawings, and shall be properly reinforced in accordance with manufacturer's specifications. The Contractor shall submit to the Contracting Officer, shop drawings showing the details of all doors.

b. The entrance door shall be double-leaf, flush type, supported at the jambs with butts as shown on the drawings. All mitre joints and butt joints shall be welded and ground smooth. The steel panels shall be not less than 16 gage. The quality of the material and workmanship shall in all respects be equal to the flush hollow metal door manufactured by the Richmond Fireproof Door Co., Richmond, Indiana.

c. The service, boiler room, pump room, interior screening room, and exterior screening room doors shall be hollow metal type, supported at the jambs with 3 butts. Stiles, rails and panels shall be formed of 18-gage steel with all joints welded and ground smooth. The quality of the material and workmanship shall in all respects be equal to the hollow metal door manufactured by the Richmond Fireproof Door Co., Richmond, Indiana. The interior screening room door shall be provided with a continuous, resilient, waterproof, pure rubber gasket at jambs, head, and sill. The door when in closed position shall be gas tight.

d. The doors shall be painted and finished at the shop in the color to be selected by the Contracting Officer and in accordance with the standard practice of the manufacturer of the doors. The doors shall be cleaned and primed with one coat of approved rust-resistant paint baked on, and one coat of mineral filler shall be baked on and rubbed before assembling. The doors shall be finished with two additional coats, baked on, the last coat being of the color selected. If the paint on the doors is marred in transit or during installation, the finish shall be replaced at the Contractor's expense to the satisfaction of the Contracting Officer.

TP7-8. DOOR FRAMES. - As shown on the drawings, the entrance and service doors shall be provided with a suitable extruded bronze saddle, properly fitted and secured in place with machine screws. All door frames shall be made of steel, accurately fitted, welded, and anchored in place as shown on the drawings. Pressed metal frames shall be formed of 16-gage steel. Loose lintels, as indicated on the drawings, shall have not less than 6 inches of bearing at each end.

TP7-9. BUILDERS' HARDWARE. - a. The Contractor shall install heavy bronze hardware for all the doors, as herein specified, including lock sets, butts, chain bolts, door checks, and other hardware for a complete installation.

b. The hardware shall be secured in place with machine screws and reinforcing plates shall be provided where necessary. The hardware shall be subject to approval of the Contracting Officer, shall be of the heavy, solid-bronze type, and of sufficient strength and size for the use intended. It shall conform to Federal Specifications FF-H- series where applicable, and unless otherwise noted shall be similar and equal to products of the P. & F. Corbin Co., New Britain, Conn., and of the type shown in the following schedule.

Entrance Doors

4 - Pairs Butts DB 272, 6"x6" TMS
1 - Set Handles, Lock and Trim DB 740-991 (For Active Door) TMS
1 - Set Dummy Trim and Handles DB 740-81 (For Inactive Door) TMS
1 - Chain Bolt DB 4252-1/2, 6" TMS
1 - Foot Bolt DB 4250-1/2, 6" TMS
1 - Door Check DB 106-1/2 TMS
1 - Bracket DB 26-1/2 for No. 106-1/2 door check
1 - Bronze Hook and Eye as required (For Inactive Door), Dull-Brass Finish

Service Door

1-1/2 - Pairs Butts DB 272, 5"x5" TMS
1 - Lock DB 6431 TMS
2 - Escutcheons DB 74030 TMS
1 - Pair Door Knobs DB 1519-1/2
1 - Door Check TMS 104-1/2
1 - Bracket DB 26-1/2 for #104-1/2 Door Check

Boiler Room Door

1-1/2 - Pairs Butts DB 071-1/2, 4-1/2" x 4-1/2" (Button Tips) TMS
1 - Latch Set DB 8310 TMS
1 - Pair Door Knobs DB 1519 PY with Rose
1 - Door Stop DB 0359-1/2 (Hand as Required)

Pump Room Door

Same as Boiler Room Door

Interior Screening Room Door

1-1/2 Pairs Butts DB 071-1/2, 4-1/2" x 4-1/2" (Button Tips) TMS
1 - Door Closer (Jamison Improved Door Closer as made by the Jamison Cold Storage Door Co., Hagerstown, Mr., or equal), Dull-Brass Finish
1 - Door Pull DB 4395
1 - Push Plate DB 2332, 12" x 3"

Exterior Screening Room Door

1-1/2 - Pairs Butts DB 272, 4-1/2" x 4-1/2" TMS
1 - Lock DB 6431 TMS
2 - Escutcheons DB 74030 TMS
1 - Pair Door Knobs DB 1519-1/2
1 - Door Check TMS 104-1/2
1 - Bracket DB 26-1/2 for #104-1/2 door check

Toilet Partition

Hardware shall be furnished and installed by manufacturer of toilet partition; and shall be heavy brass, chromium-plated.

TP7-10. ROOFING. - a. Deck. - The roof slab and beam covering shall conform to the requirements for concrete as specified in Section VI. Before taking its initial set the concrete shall be struck off approximately to grade and then roughened with a broom. When directed by the Contracting Officer or, in any event, not less than 48 hours after the concrete has been placed, the Contractor shall thoroughly clean the concrete surface, dampen it and place a filler of cinder concrete to the lines and grades indicated on the drawings (see Paragraph TP6-9). The cinder concrete shall be provided with expansion joints, one adjacent to the parapet and the other dividing the slab, at the locations shown on the drawings. (See Paragraph TP6-17.) Cinder concrete shall be struck off and wood-float-finished to a surface with a reasonably smooth finish. Forms and shores under the roof slab shall not be removed or disturbed in less than 14 days after placing of the cinder concrete and then only upon specific authorization of the Contracting Officer.

b. The cinder concrete filler shall be covered with a built-up gravel roof as follows: Before the application of any roofing materials, the concrete slab shall be smooth, clean, firm, and dry. The entire surface of the slab shall then be coated uniformly with an approved asphalt primer, using not less than one gallon of primer for each 100 square feet of roof surface. Not less than 24 hours after the application of the priming coat the entire surface shall be coated uniformly with hot asphalt conforming to Federal Specification SS-A-666, Type I, Class A, "Asphalt; (For) Built-Up Roofing, Waterproofing, and Damp-Proofing". Into this coating, while hot, there shall be mopped four plies of 15-pound, 36-inch aspahlt-saturated felt over the entire surface of the roof, lapping each sheet 27-1/2 inches over the preceding one, lapping the ends of the sheets not less than 6 inches, and mopping with asphalt the full 27-1/2 inches so that in no place shall felt touch felt. The felt shall conform to Federal Specification HH-F-191a for Asphalt-Saturated Felt. At all vertical surfaces the roofing shall be carried up at least 6 inches or 6 inches above top line of cants and thoroughly mopped to the wall so that contact is obtained throughout. The plies of felt shall be laid so as to be free from wrinkles and buckles. After all plies have been laid and all flashings and connections installed, there shall be poured from a dipper a uniform

coating of asphalt, into which, while hot, there shall be embedded not less than 400 pounds of gravel per 100 square feet. Not less than 160 pounds of asphalt shall be used for constructing each 100 square feet of the completed roof. The roofing gravel shall be cleaned, durable, water-worn, dry, and free from clay, loam, sand or other foreign substances. All gravel shall pass a 3/4-inch square mesh sieve, not less than 80 per cent shall pass a 3/8-inch square mesh sieve, and shall be retained on a 1/4-inch square mesh sieve, and 100 per cent shall be retained on a 1/8-inch square mesh sieve.

TP7-11, FLASHINGS. - a. Copper flashing. - All copper flashings unless otherwise noted on the drawings or otherwise required shall be 16-ounce copper conforming to Federal Specification QQ-C-501a. Cold rolled hard The chimney shall be flashed and counterflashed. The concrete bases for the exhaust silencers shall be flashed as shown on the drawings.

b. Fabric flashing. - The saturated fabric flashing, shown on the drawings, shall be similar and equal to the through-wall flashings manufactured by Sendell Manufacturing Corporation, 70 Phillips Street, Watertown, Massachusetts, or to the Wasco copper-fabric flashing, manufactured by Wasco Flashing Company, Cambridge, Massachusetts, and shall be well bedded in mortar joints.

TP7-12, LOUVERS. - Where shown on the drawings, louvers of the type and size indicated shall be installed. The frame of the adjustable louvers shall be of 32-ounce and the blades of 48-ounce cold-rolled copper mounted on bronze bearings and shall be similar and equal to the Beco Adjustable Stormproof Louver manufactured by the H. H. W. Bergmann and Co., New York, N. Y. The stationary louvers shall be constructed of 16-ounce cold-rolled copper and shall be similar and equal to Hoal's Leakproof Wall Louver as manufactured by the H. H. W. Bergmann and Co., New York, N. Y. All louver frames shall be constructed with watertight connection between the frame and the wall. All louvers shall be equipped on the exterior with 1/2-inch mesh, 16-gage copper wire, backed up with 16-mesh copper insect screen permanently attached to louvers. The Contractor shall furnish detailed drawings for approval, showing method of anchoring the louvers in place.

TP7-13. STEEL PARTITION. - The partition and door enclosing the plumbing fixtures shall be similar and equal to the panel type partition, Type "Challenger" as manufactured by Mills Co., Cleveland, Ohio, complete with all necessary hardware, and shall be painted with a color selected by the Contracting Officer in accordance with the standard practice of the manufacturer of the partition. The Contractor shall furnish detail drawings of the partition for approval. Door shall be equipped with gravity bottom hinge, covered top hinge, rattle-proof slide bar latch, rubber-faced bumper, coat and hat hook and shockproof ornamental pull. All hardware shall be heavy chromium-plated brass.

TP7-14. DOWNSPOUTS. - a. The Contractor shall install the copper downspouts with scupper box heads, bronze beehive strainers and cast-iron leader shoes, as indicated on the drawings.

b. The Contractor shall submit for approval detail drawings for the scupper box head he proposes to install, in sufficient detail to check the design.

TP7-15. MISCELLANEOUS DETAILS. - a. The Contractor shall install the bronze letters on the South Elevation as shown on the drawings; and shall submit, for approval, details and template for pinning and setting the letters.

b. The bronze letters shall conform to Federal Specification QQ-B-721a in reference to applicable parts therein known as "architectural bronze" in the commercial trade and best suited for the particular fabrication and design. The workmanship and finish of the letters shall be first class and suitable for the purpose as approved by the Contracting Officer.

c. Wire Mesh Window Guards. - Full length, removable wire mesh window guards shall be installed on all glass block openings except over main entrance door. Frames shall be formed of 1"x1/2"x1/8" channels and shall be fastened to 1-1/2" x 1/2" steel bar jamb with non-ferrous flat head machine screws. Wire mesh shall be Number 12 gauge, 1-1/4 inch mesh, galvanized by the hot-dip process. Horizontal stiffener channel bars shall be installed on frames as shown on the drawings.

TP7-16. PAINTING. - The concrete floor, concrete machinery bases, and side walls to a height of 5'-6" above finish floor, of the engine room, shall be painted as specified in Paragraph TP17-7.

TP7-17. PAYMENT. - a. Payment for constructing the pumping station superstructure, complete, in accordance with the specifications and the drawings will be made at the contract price for Item 11, "Pumping Station Superstructure".

b. The cost of all painting shall be included in the contract price for Item 11. See Paragraph TP6-22 and drawings for payment of concrete work not included under Item 11.

SECTION VIII. MISCELLANEOUS METALS (Items 12 and 13)

TP8-1. GENERAL. - All metals, unless otherwise specified, shall conform to applicable Federal Specifications, and, when not covered thereby, to applicable A.S.T.M. Designations. All castings shall have the pattern or mark number cast on them. Unless otherwise authorized by the Contracting Officer, the scale weights of each casting or forging after machining shall be within 5 per cent of the weights as calculated from the dimensions specified or shown on the drawings. Castings shall conform, at the minimum section thereof, to within 1/16 inch of the dimensions shown on the drawings.

TP8-2. MATERIALS AND WORKMANSHIP. - a. The articles included in Items 12 and 13, other miscellaneous materials, and all metal required in the work, except as otherwise specified, shall meet the requirements of the following specifications where applicable to the use intended.

(1) Structural steel. - Structural steel shall conform to Federal Specification QQ-S-741. The shapes, plates, bars, pins and bolts shall be Type I, Grade B, unless otherwise specified or required. Welding will be accepted only where specified or authorized, and approved only when done in accordance with the current requirements of the American Welding Society.

(2) Cold-rolled steel. - A.S.T.M. Designation A 108-36 for "Commercial Cold-Finished Bar Steels and Cold-Finished Shafting". Unless otherwise specified, this material shall be used for rods, pins, keys, and similar parts.

(3) Hot-rolled steel for shafting, sleeves and rollers. - A.S.T.M. Designation A 107-36 for "Commercial Quality Hot-Rolled Bar Steels".

(4) Machine steel. - Same as for Hot-Rolled Steel.

(5) Steel, corrosion-resisting. - Federal Specification QQ-S-766a.

(6) Steel forgings shall be of hot-rolled open-hearth steel forging bars conforming to A.S.T.M. Designation A 235-42 for "Carbon-Steel For General Industrial Use, Forgings, Class C".

(7) Steel castings. - Federal Specification QQ-S-681b.

(8) Iron castings, gray. - Federal Specification QQ-I-652, class as indicated. Tensile tests and chemical analysis will not be required.

(9) Malleable iron castings. - Federal Specification QQ-I-666a, Class A.

(10) Steel rail track and fittings shall conform to standard A.S.C.E. sections and standard A.R.E.A. requirements.

(11) Chains and attachments. - Federal Specification RR-C-271a of Type A and Grade II unless otherwise specified.

(12) Bolts, screws, and washers. - Appropriate Federal Specifications and current standard practice, unless otherwise specified.

(13) Wrought-iron bars and shapes. - Federal Specification QQ-I-686a, Grade B.

(14) Wrought-iron pipe. - Federal Specification WW-P-441a.

(15) Cast-iron pipe. - Federal Specification WW-P-401 for soil pipe.

(16) Black steel pipe and fittings. - Federal Specification WW-P-406, Class A, and WW-P-521b.

(17) Copper. - Federal Specification QQ-C-501a and QQ-C-591a, as applicable.

(18) Zinc coatings (hot-galvanized). - Federal Specification QQ-I-716.

(19) Babbitt metal. - Federal Specification QQ-M-161.

(20) Classes "C" and "D" Bronze for slide gate seats shall be cast bronze made of the best grade of virgin metals, and shall have the following chemical composition:

Class "C" Bronze

Copper	82.00 to 83.00 per cent
Tin	6.75 to 7.50 per cent
Lead	4.50 to 5.00 per cent
Zinc	5.00 to 6.00 per cent

Class "D" Bronze

Copper	82.00 to 83.00 per cent
Tin	4.75 to 5.50 per cent
Lead	7.75 to 8.25 per cent
Zinc	4.00 to 5.00 per cent

(21) Lead. - Federal Specification QQ-L-171, Grade A.

(22) Solder. - Appropriate Federal Specifications QQ-S-551 and QQ-S-571a.

(23) Malleable-iron fittings. - Federal Specification WW-P-521b.

(24) Steel reinforcement. - Steel reinforcement shall be of new billet, intermediate grade, open-hearth steel, deformed, and shall conform to Federal Specification QQ-B-71a for "Bars; Reinforcement, Concrete, Type B, Grade 2, dated January 12, 1938". Certified copies of mill tests required shall be furnished by the Contractor and the steel shall be subjected to such tests as the Contracting Officer may consider necessary to establish its quality, including particularly the requirements of bending and elongation.

b. Other items, unless otherwise specified, shall conform to current standard practice for the material required and use intended.

TP8-3. GALVANIZING AND PAINTING. - a. Galvanized iron or steel articles shall be galvanized by the hot-dip process unless otherwise permitted. Injuries to the galvanizing shall be satisfactorily repaired by the Contractor at no additional expense to the Government. Provision shall be made for protecting threads to make a very loose fit before galvanizing, and carefully rerunning threads after galvanizing to leave a good coating over all threads. Hot galvanizing shall be of such quality that it will endure at least 4 one-minute immersions in copper sulphate solution, in accordance with the requirements of the Preece Test.

b. Except as otherwise specified, all ungalvanized iron and steel to be exposed in the finished work shall be thoroughly cleaned and then thoroughly and evenly painted, in accordance with the provisions of Section XVII.

TP8-4. MISCELLANEOUS IRON AND STEEL (Item 12). - a. Work included. - Frames, covers, ladders, steps, floor drain, safety treads, and other miscellaneous iron and steel items shall be installed as shown on the drawings. The Contractor shall submit for approval detailed drawings and data descriptive of the miscellaneous iron and steel work which he proposes to install.

b. Measurement and payment. - Measurement and payment for Item 12, "Miscellaneous Iron and Steel", will be made as specified in Paragraph TP8-5 b.

TP8-5. MISCELLANEOUS PIPE AND FITTINGS (Item 13). - a. Work included. - (1) Black-steel or wrought-iron pipe complete with malleable-iron fittings and connections, or welded, shall be installed as shown on the drawings. Pipe shall be of the size as shown on the drawings and shall conform to Federal Specifications WW-P-406 and WW-P-441a. Pipe fittings and connections, as shown on the drawings, shall be malleable-iron castings (see Paragraph TP8-2 a), of ball pattern and pin-connected where required. Floor or wall flanges of screw type shall be anchored into the concrete with stud type expansion bolts consisting of one primary and one secondary expansion unit similar and equal to that manufactured by Akerman Johnson Company. The Contractor shall submit for approval

detailed drawings and data descriptive of the miscellaneous pipe and fittings which he proposes to install. Welding shall be accomplished as specified in Paragraph TP8-2 a (1).

(2) All anchor bolts, sleeves, nuts, and washers, required for the installation of equipment furnished by the Government shall be included in this item of work.

b. Measurement and payment. - (1) Measurement will be made by the pound for the amount of metal installed in the work in accordance with the drawings and specifications. Wherever practicable, the quantities shall be determined by weighing the articles and materials on the most accurate scales available. The weight will be determined by the Contracting Officer who will use, in his discretion, for that purpose scale weights, railroad shipping weights, manufacturers' weights, catalog weights or computed weights. The weight of all tare, packing, and blocking will be deducted, using only net weights for payment quantities; provided, that no payment will be made for any weight in excess of 5 per cent more than the computed weights as determined from the drawings.

(2) In calculating computed weights the following unit weights of the several materials will be used unless otherwise specified:

Structural Steel	- 0.2833 pounds per cubic inch
Cast Iron	- 0.2604 pounds per cubic inch
Wrought-Iron Pipe	- The weight per linear foot shown in Table I of Federal Specification WW-P-441a.
Black Steel Pipe	- The weight per linear foot shown in Table I of Federal Specification WW-P-406.

(3) Payment will be made at the applicable contract unit prices for Items 12 and 13.

(4) Payment for painting will be made in accordance with the provisions of Paragraph TP17-9.

SECTION IX. MECHANICALLY CLEANED BAR SCREENS (Item 14)

TP9-1. WORK INCLUDED. - The Contractor shall install two mechanically cleaned bar screens complete in all details and ready for operation in the locations as shown on the drawings or as directed by the Contracting Officer. Each mechanically cleaned screen shall consist of a bar screen, screen frame, channels set in concrete, cleaning device, drive mechanism with motor and magnetically operated motor starter, discharge hopper and three screenings cans with covers.

TP9-2. MATERIALS. - All materials used in the construction of the mechanically cleaned screens shall be of the best quality and entirely suitable in every respect for the service required. All structural steel shall conform to the Federal Specification QQ-S-741 for Structural Steel. All iron castings shall conform to the Federal Specification QQ-I-652 and shall be of suitable class for the purpose intended. Other materials shall conform to the applicable Federal Specifications.

TP9-3. BAR SCREENS. - The bar screens shall consist of bars not less than 3/8 inch by 2-1/2 inches in cross section, spaced with 1-1/2-inch clear openings between bars, with bars set straight and true and held firmly in place.

TP9-4. CLEANING RAKES. - The rakes for each mechanically cleaned screen shall be of sufficient width to clean the entire width of bar screen and shall be cadmium plated, copper bearing steel with milled teeth or of cast steel or other approved material. The rakes shall be suitably reinforced and the teeth shall be not less than 3/4 inch thick and of such length to project 1-1/4 inches in the bars, and of suitable shape to thoroughly clean the screens without pushing material through the screens. Suitable provision shall be made for keeping the rake teeth in proper contact with the bars for complete cleaning, and without undue friction, to prevent the possibility of the rake jumping over unusually heavy accumulation of screenings on the bars.

TP9-5. CHAIN, SPROCKETS AND BEARINGS. - Chains for actuating the rakes shall be of approved material having the proper strength and durability for wear and attack from sewage. The chains shall be of the pintle type, of 6-inch pitch, with an ultimate tensile strength of not less than 30,000 pounds and average Brinell hardness of 170 to 200. Attachments shall be riveted in place with high-carbon, heat-treated, copper-bearing steel pins. Sprockets shall be of close-grained cast iron with chilled teeth and rim, and the teeth shall be ground to accurately fit the chain. Sprockets shall be split and bolted. Bearings shall be babbitt bearings at head shaft with industrial type fittings for pressure grease lubrication. Shafting shall be of cold-rolled steel. A take-up shall be provided at each upper bearing providing for at least 6-inch movement. Bronze nuts shall be used for adjustments.

TP9-6. DRIVING MECHANISM. - The rake shall be powered by an electric motor through a suitable oil immersed speed reducer of substantial design and suitable for the conditions of service. Shafts shall run on roller bearings and gears shall be enclosed in a heavy cast iron moisture and oil proof case. Where required, a shearing pin or other approved device shall be provided in the driving mechanism to protect against overload. The shearing pin or other device shall be readily accessible. Six spare shearpins shall be furnished with each screen.

TP9-7. MOTOR AND MOTOR STARTER. - a. The motors for driving the mechanically cleaned bar screens shall be explosion-proof induction motors suitable for operation on 220-volt, three-phase, 60-cycle, A.C. power. Each screen shall be driven by its own motor. Each motor shall be of ample rating to drive the screen mechanism continuously with a rise in temperature not to exceed 55 degrees above an ambient temperature of 40 degrees Centigrade.

b. Each motor shall be provided with a combination magnetic reversing "across-the-line" type of explosion-proof motor starter. The starter shall be equipped with two thermal overload protection elements for each of the forward and reverse contactors, reset buttons in the cover, and heaters suitable for the motor furnished. The manually operated switch shall be unfused. The starter shall be equipped with explosion-proof push buttons for "Forward", "Stop" and "Reverse-Jog" operation and shall be connected for jogging action on the reverse only. Forward and reverse contactors shall be mechanically interlocked and equipped with low voltage release. The control shall be similar and equal to General Electric Company's Type CR7010, Size 1, NEMA type 7, complete with heaters.

TP9-8. HOUSING, HOPPER AND GUARD. - Proper guards shall be provided for sprockets and housings shall be provided to the extent necessary to prevent splashing the adjacent floor by water from rake or screenings. Housings, hopper and sprocket guard shall be made of galvanized copper bearing steel sheets not less than No. 12 gauge thickness, or equal. Suitable access doors properly reinforced shall be provided.

TP9-9. CANS AND COVERS. - The cans shall be water-tight approximately 20 inches in diameter by 24 inches high, of No. 12 gauge galvanized steel, properly reinforced and fitted with lifting handles. Covers shall be provided for the cans, so designed that the joint between cover and can will be flyproof.

TP9-10. DESIGN. - The detailed design for the mechanically cleaned bar screens complete shall be such that all working parts will be readily accessible for inspection and repair, easily duplicated and readily replaced. Each and every part of the equipment shall be properly designed and suitable for the use and service required.

TP9-11. DRAWINGS. - The Contractor shall submit for approval detail drawings for the mechanically cleaned bar screens he proposes to install in sufficient detail to check the design. These drawings shall include a complete and itemized list of all parts, with the grade and class of material or make of a standard article the Contractor proposes to furnish. The item number in the list of parts shall be shown on the drawings by means of a circle enclosing the item number and a solid light line connecting the circle to the part. Proposed con-

struction shall be clearly shown on the drawings by the liberal use of sections, enlarged details or by other means. Any item or part needed to provide a complete and workable installation, in accordance with the intent of these specifications, shall be supplied by the Contractor whether or not the same is included on the drawings, the list of parts, or in the requirements of these specifications. Approved drawings submitted by the Contractor shall become a part of these specifications.

TP9-12. MATERIALS AND WORKMANSHIP. - Each bar screen with its accessories, shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as furnished by the Contractor and approved by the Contracting Officer, and shall conform to the provisions of Section VIII, where applicable. All metal workmanship shall be of approved standard quality.

TP9-13. INSTALLATION. - Each bar screen shall be completely assembled during installation. Care shall be exercised when drawing the frame up to the concrete to insure its being pulled against a true surface. All bolts shall be tightened carefully so as not to strain or warp the parts and to preserve proper alignment. Grout shall be poured between the face of the flange and the concrete to prevent any tendency to spring the frame. All anchor bolts, nuts, etc., shall be made of corrosion resisting steel.

TP9-14. INSPECTION AND TESTS. - a. The bar screens and accessories to be installed shall be assembled in the shop as directed by the Contracting Officer for inspection and to insure that all parts fit accurately and are in proper alignment.

b. After completion of the pumping station and the installation of all machinery, each bar screen shall be tested for satisfactory operation. Any adjustments in the setting or installation required to secure satisfactory operation of the bar screens shall be made by the Contractor. The bar screen motors shall be tested as directed and any adjustments or changes that may be required, in the opinion of the Contracting Officer, shall be performed by the Contractor.

TP9-15. PAINTING. - a. All parts of the mechanically cleaned bar screens (except chains, sprocket teeth and bearings) shall have one coat of metal filler, one shop coat of red lead and one field coat of red lead paint and two finish coats of graphite paint, of a color approved by the Contracting Officer. Painting shall be similar or equal to Detroit Graphite Company Iron-Gard System for underwater steel structures.

b. Bearing areas of shafts, chains, sprocket teeth and all other surfaces which cannot be painted shall be coated with grease for protection during shipment and installation.

TP9-16. PAYMENT. - a. Payment for designing, furnishing, painting and installing equipment and materials as specified herein will be made at the contract unit price for Item 14 "Mechanically Cleaned Bar Screens."

b. Partial payments up to 50 per cent of the contract price will be made when the mechanically cleaned bar screens, complete, are delivered to the site of the work, provided the quality of such equipment is satisfactory to the Contracting Officer, but in no case will the payment exceed the cost of the equipment delivered to the site of the work. If any equipment stored and partially paid for is not kept protected, no further partial payments will be made.

c. Payment for all testing shall be included in the contract price for Item 14.

SECTION X. SLUICE GATES, COMPLETE WITH HOISTS (Item 15)

TP10-1. WORK INCLUDED. - The Contractor shall design and install three unseating pressure sluice gates, complete with electric motor operated hoists, sleeves, anchor bolts and accessories, all in accordance with the drawings and the specifications.

TP10-2. DESCRIPTION. - a. The gates shall be of cast iron with bronze seals. The dimensions of the gate openings shall be as shown on the drawings. The gates shall be operated by means of a rising-stem hoist actuated by an electric motor. The hoists shall have a capacity sufficient to permit satisfactory operation of the gates when the gates are under a hydrostatic head of 20 feet. The gate in the gravity flow conduit shall be designed to withstand a maximum hydrostatic head of 40 feet above the center line. The two gates in the pumping station shall be designed to withstand a maximum hydrostatic head of 20 feet above the center line. The following is a tabulation of the above information:

Designation	No. Req'd	Gate Opening	Maximum Design Head (Unseating)	Maximum Operating Head
A	2	72" x 72"	20 feet	20 feet
B	1	72" x 72"	40 feet	20 feet

b. The leaf of each gate shall consist of a rectangular cast iron plate with horizontal and vertical ribs. Bronze seat facings shall be driven into dovetail grooves machined in the face of the gates. The leaf shall have a pocket cast in the center near the top, heavily reinforced by ribs into which shall be fitted a solid manganese-bronze thrust nut, threaded and keyed to the stem. This thrust nut provides the attachment between the stem and the leaf and shall be of ample size to take the thrust both ways.

TP10-3. UNSEATING PRESSURE GATE. - a. Leaf. - The unseating pressure gate leaf shall conform to all the requirements of Paragraph TP10-2 b, and in addition shall be fitted with four wedges on each side and two top and two bottom wedges. The leaf shall have tongues on each side extending the full length of the leaf and those tongues shall be accurately machined all over. The side wedges shall be of solid bronze and shall be of the adjustable type, and shall be provided with tongues on the back to slide in vertical keyways, machined in the leaf, and shall be secured to the leaf by shouldered steel studs and bronze nuts. They shall have solid bronze adjusting bolts. The side wedges shall be machined on all bearing surfaces and shall make accurate contact with the bronze wedge facings attached to the guides. The top and bottom

wedges s all be of solid manganese-bronze and shall be of the adjustable type. The wedges shall be attached to the leaf by shouldered steel studs and bronze nuts and shall have solid bronze adjusting bolts. The wedges shall be machined on all bearing surfaces and shall make accurate contact with the wedge seats attached to the frame. The leaf shall be not less than one inch thick and shall be suitably reinforced with horizontal and vertical ribs.

b. Unseating pressure gate frame and guides. - (1) Gate frames shall be of the flanged type specially designed and drilled to permit easy access to all anchor bolt nuts after installation. The rear face shall be machined and will be attached to concrete. The front face shall be machined to take the sluice gate guides.. The frames shall be of cast iron of ample section to prevent distortion and shall be cast in one piece. Bronze seat facings shall be driven into dovetail grooves machined in the front face of the frame. All anchor bolts shall be of corrosion resisting steel.

(2) The guides shall be of cast iron and of sufficient length so that not less than one-half of the gate is within the guides when the gates are fully open. Slots shall be machined the full length of the guides and shall be of such dimensions that there is not over 1/16 inch clearance with the tongues on the side of the leaf. The guides shall be machined to fit the frame and shall be bolted to the frame with steel studs and keyed to the frame to prevent lateral movement. Holes for studs shall be spot faced. The guides shall be reinforced with heavy ribs at points of contact with the wedges on the leaf and shall be capable of taking the whole thrust due to water pressure and wedging action. Heavy bronze wedge facings shall be provided at points of contact. Wedge facings shall be machined on all bearing surfaces and shall make accurate contact with wedges on the leaf.

TP10-4. GATE STEMS. - a. The gates shall have rising stems of sufficient size to withstand safely, without buckling, the whole thrust due to closing the gate under the maximum operating head. The stems shall be capable of withstanding the maximum thrust of the hoist. The gate stem shall be cold-rolled steel in sections not exceeding 10 feet in length. The sections of each stem shall be joined together by solid manganese-bronze couplings threaded and keyed to the stems.

b. Each stem shall be furnished with stem guides so that the unsupported length of stem shall not exceed 10 feet. All stem guides shall be bronze bushed and adjustable.

TP10-5. ELECTRIC HOISTS. - a. General. - The gate hoists shall be electric motor-operated, pedestal type, one for each of three gates as shown on the drawings, complete with electric motor and controls, stems, stem guides, stem pipe covers, torque plates, accessories and position indicator, and shall be sufficient in capacity to raise and lower the gates against the maximum operating head.

b. Description. - (1) The sluice gates shall be operated by electric motor-operated hoists designed to lift the gates against the maximum operating head (see Paragraph TP10-2 a). The hoist shall have a minimum stem raising and lowering speed of one foot per minute.

(2) The pedestal and gear case shall be constructed of high grade cast iron with provisions made for attaching stem cover to top cover plate. A suitable torque plate shall be provided at the base of the pedestal. Electric contactor cases and push button cases shall be cast as integral parts of the pedestal and shall have cast iron covers with machined and gasketed watertight and dust-tight joints.

(3) All gears shall be of steel properly designed for the service intended. The gear shafts shall be provided with bronze bushings. Gearing shall be enclosed in dust-tight casings and shall be so designed that it will not be necessary to run the gears in oil or grease. Spur gearing shall be used. The stands shall include automatic mechanical hammer-blow devices or other apparatus to allow the motor to come up to speed before unseating the gates.

(4) A handwheel, with disconnecting handle connected to the stem by suitable gearing, shall be provided for hand operation of each hoist. The handwheels shall not revolve when the hoists are electrically operated, and the motors shall be automatically prevented from starting when the hoists are being hand-operated, or when the "hand-motor" handles are in the "hand" position.

(5) Suitable visual indicators shall be provided so that the exact position of the gates can be determined at all times.

(6) The hoists shall be equipped with stem covers of threaded wrought iron pipe with suitable caps.

c. Gate hoist electrical equipment. - (1) The hoist motor shall be mounted on the pedestal and arranged so that the controls are built in, completely enclosed and waterproof. The motor shall be direct connected through a train of spur gears and shall be the single speed, high torque, low starting current type. The motor shall be designed for 220-volt, 3-phase, 60-cycle power to operate at a speed of not over 900 r.p.m. It shall be of the squirrel cage type, rated for 30-minute operation and shall be equipped with all necessary starting apparatus and protective devices. The starting torque of the motors at rated voltage and frequency shall be not less than 250 per cent full load torque. The motor shall be equipped with grease-packed ball-bearings and splash-proof housing. Insulation shall be impregnated with special moisture-and acid-resisting compound.

(2) The controllers shall be of the full magnetic reversing type, designed for across-the-line starting; and controlled by a three-way push-button station, so that the gates may be raised, lowered, or stopped at any desired point in their travel. The controllers shall

be provided with undervoltage, and thermal overload protection accomplished by suitable relays. Overload relays shall be of the automatic reset type. The limits of travel of the gate in both upward and downward directions shall be accurately determined by quick-break limit switches geared directly to the gate stems. The switches shall be designed to absolutely prevent "drift" or jamming of the gate. The switches shall be housed in oil-tight cases and shall be equipped with quick-break contacts with micrometer adjustment. Each hoist shall contain a motor contactor equipped with separate "open" and "close" contactor arms, mechanically interlocked, and provided with arc shields. The contactor shall be of ample size and rating to make and break the current required by the motor under all conditions. Push buttons shall be provided. The push buttons shall be clearly labeled "open", "close" and "stop". A pilot light shall be installed, indicating that the motor is ready to be operated. All electrical apparatus shall be installed, and internal connections shall be made by the hoist manufacturer. The wiring shall terminate at a suitable enclosed terminal board.

(3) The hoist shall have a hoisting speed with the electric motor of not less than one foot per minute. A gate-position indicator shall be included on the hoists. The gate-position indicator shall be plainly visible from the push-button station.

(4) Unless otherwise specified, all electrical materials and tests shall conform with the current standard rules, regulations, and specifications of the American Institute of Electrical Engineers and of the National Electrical Manufacturers Association.

TP10-6. FURNISHINGS AND FITTINGS. - a. The gate frames, guides and hoists shall be designed and constructed to provide a satisfactory method of fastening them securely to concrete or other supports as shown on the drawings. All bolts, special tools, and other devices necessary to erect the gates, frames, guides, and hoists as shown on the drawings shall be included under this item.

b. All bolts, nuts, screws, studs, pins, etc., shall be securely locked by satisfactory devices that will prevent loosening due to vibration.

TP10-7. DESIGN. - a. The detailed design for the sluice gates, hoists, and accessories shall be such that all working parts shall be readily accessible for inspection and repair, easily duplicated, and readily replaced. Each and every part of the equipment shall be properly designed and suitable for the use and service required.

b. The design stress for any member or part of the material covered by these specifications shall not be greater than one-sixth of the ultimate strength of the material used.

TP10-8. DRAWINGS. - The Contractor shall submit for approval detail drawings for the sluice gates, hoists, and accessories he proposes

to install in sufficient detail to check the design. These drawings shall include a complete and itemized list of all parts, with the grade and class of material or make of a standard article, the Contractor proposes to furnish. The item number in the list of parts shall be shown on the drawings by means of a circle enclosing the item number and a solid light line connecting the circle to the part. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details or by other means. Any item or part needed to provide a complete and workable installation in accordance with the intent of these specifications shall be supplied by the Contractor whether or not the same is included on the drawings, the list of parts, or in the requirements of these specifications. Approved drawings submitted by the Contractor shall become a part of these specifications.

TP10-9. MATERIALS AND WORKMANSHIP. - Each gate, with its hoist and accessories, shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as furnished by the Contractor and approved by the Contracting Officer, and shall conform to the provisions of Section VIII, where applicable. All metal workmanship shall be of approved standard quality.

TP10-10. INSTALLATION. - Each gate shall be completely assembled during installation and the leaf shall be rigidly held in place against the seat by means of jack screws. Care shall be exercised when drawing the frame up to the concrete to insure its being pulled against a true surface. All bolts shall be tightened carefully so as not to strain or warp the parts and to preserve proper alignment. Non-shrinking grout made with cement similar and equal to "Embeco" cement as manufactured by Master Builders of Cleveland, Ohio, shall be placed between the face of the flange and the concrete to prevent any tendency to spring the frame. After installation, the jack screws shall be removed.

TP10-11. INSPECTION AND TESTS. - a. The gates, hoists and accessories to be furnished shall be assembled in the shop as directed by the Contracting Officer for inspection and to insure that all parts fit accurately and are in proper alignment. Each gate shall be opened and closed to insure proper operation.

b. After completion of the pumping station and the installation of all machinery, each gate shall be tested for satisfactory operation by being raised and lowered several times for its full length of travel. Any adjustments in the setting or installation required to secure satisfactory operation and tight closure of the gates shall be made by the Contractor. The gate hoists shall be tested as directed and any adjustments or required changes, in the opinion of the Contracting Officer, shall be performed by the Contractor at no additional expense to the Government.

TP10-12. PAINTING. - a. Gates and gate guides shall be given one coat of metal filler, one shop coat of red lead and one field coat of

red lead paint, and two finish coats of graphite paint. Painting shall be similar and equal to Detroit Graphite Company Iron-Gard System for Underwater steel structures.

b. Gate hoists shall be given one coat of metal filler, one shop coat of red lead, one field touch-up coat of red lead if found necessary by the Contracting Officer, and two coats of selected engine enamel.

TP10-13. PAYMENT. - a. Payment for designing, furnishing, painting and installing the work as specified herein will be made at the contract price for Item 15 "Sluice Gates, Complete with Hoists".

b. Partial payments up to 50 per cent of the contract price will be made when the sluice gates, complete, are delivered to the site of the work provided the quality of such equipment is satisfactory to the Contracting Officer, but in no case will the payment to the Contractor exceed the cost of the equipment delivered to the site of the work. If any equipment stored and partially paid for is not kept protected, no further partial payments will be made.

c. Payment for all testing shall be included in the contract price for Item 15.

PART IV

SECTION XI. HEATING AND VENTILATING EQUIPMENT (Item 16)

TP11-1. WORK INCLUDED. - a. The Contractor shall install and place in operation the steam heating equipment and the engine-room, pump-room and screening room ventilating equipment. The steam heating system shall be of the two-pipe, gravity type consisting essentially of a combination boiler and oil burner unit, a 1000-gallon fuel oil storage tank relocated and converted from the existing 1000-gallon gasoline tank, and six unit heaters located in the engine-room, together with steam piping, valves, traps and all accessories and appurtenances herein required or shown on the drawings. The ventilating equipment shall consist essentially of two fans located on the roof of the pumping station, a blower with connecting duct work for exhausting air from the pump-room and a blower for forcing fresh air into the screening room. All piping and connections shall conform to local laws and regulations.

b. The Contractor shall submit for approval detailed drawings and data descriptive of the boiler and oil burner unit, fuel tank and piping which he proposes to install. The Contractor shall also furnish descriptive data on the unit heaters, ventilating fans, motors and controllers which he proposes to install.

TP11-2. BOILER AND BURNER. - a. A boiler and burner shall be installed complete with insulated jacket, relief valve, gage glass, try cocks, pressure gage and automatic controls as herein specified. The installation shall be in strict accordance with the manufacturers' recommendations and shall be located to allow adequate space for cleaning and maintenance. Name plates giving manufacturers' name, address, trade name and catalog number shall be securely attached to each major item of equipment. A distributing agent's name will not fulfill this requirement.

b. The boiler shall be of the cast-iron sectional type designed for a steam working pressure of 15 pounds per square inch gage. The capacity shall be not less than 1250 square feet of net installed steam radiation. The boiler shall be constructed of the best quality gray cast iron and shall have an insulated steel jacket. Color of jacket shall be as approved by the Contracting Officer. The boiler shall be specially designed for efficient operation with the particular oil burner selected.

c. The oil burner shall be of the motor driven, horizontal type and shall consist of a motor, fan, fuel oil pump, pressure regulating valve and horizontal atomizer, all combined into one integral unit. The unit shall mechanically atomize the oil and vigorously and thoroughly mix the oil vapor with the proper quantity of air. Excess air shall be kept within efficient limits and shall be supplied in carefully regulated quantities. The burner shall be provided with a means of interlocking the variable primary air control, secondary air intake damper and fuel metering valve. The burner shall be arranged for automatic electric

ignition. Operation of the burner shall be fully automatic. The motor shall be provided with overload protection. The unit shall be capable of handling fuel oil with a gravity range between 28 and 32 degrees Baume without oil heating equipment. The oil burner shall have sufficient capacity to develop not less than 125 per cent of the specified boiler capacity and shall be specially designed for efficient operation with the particular boiler selected.

d. The boiler combustion chamber or furnace shall be constructed of standard first quality firebrick in strict accordance with recommendations of the oil burner manufacturer and shall provide for complete and proper combustion without the necessity of constructing a pit below the level of the boiler room floor. The furnace shall be arranged to provide a maximum heat release of 30,000 B.T.U. per cubic foot per hour. The side walls of the furnace shall be not less than 4-1/2 inches and the rear wall not less than 9 inches thick. Wing walls shall be provided extending from the burner opening to tie in with the furnace side walls. Refractory walls shall extend to at least 6 inches above the bottom of the water leg. All firebrick shall be laid up in high temperature cement with provision for expansion joints. Adequate expansion joints at corners and intersections of wing walls with furnace side walls shall be provided. Allowance for expansion shall be 1/16 inch per running foot of wall. Target walls and ignition arches shall be provided as required for best burner performance. The floor of the furnace shall consist of two 2-1/2 inch layers of firebrick laid flat. The Contractor shall submit for approval detail drawings showing the proposed refractory furnace construction.

TP11-5. UNIT HEATERS AND CONTROLS. - a. General. - The Contractor shall install, approximately where indicated on the drawings, unit heaters with propeller type fans having capacities of not less than shown on the drawings. The unit heaters shall be rated in accordance with the Code adopted by the Industrial Unit Heater Association and the A.S.H. & V.E.

b. Support. - The heaters shall be suspended firmly from the beams or other structural members by means of approved hangers, with proper allowance for expansion and contraction and proper provision against vibration. In no case shall the steam pipes be permitted to support any part of the weight of the unit heater either during or after its installation.

c. Construction. - Unit heaters shall be of the suspended type, arranged for horizontal discharge of air. The heating element shall be of copper, shall be free to expand or contract without developing leaks, and shall be properly pitched for drainage. It shall be tested at the factory and proved tight under a hydrostatic pressure of 200 pounds per square inch, and a certified copy of the test report shall be delivered to the Contracting Officer. The casing shall be solidly and rigidly built, and finished with lacquer or enamel.

d. Piping. - The control valve shall be the same size as the supply connection indicated, and the piping connections shall be as indicated on drawings unless otherwise directed by the Contracting Officer. No piping shall be connected to any unit heater until the Contracting Officer is satisfied that such heater has been properly and permanently supported as specified in subparagraph b above.

e. Motor. - The motor shall be 115-volt single phase fully enclosed with a metal hood, but shall be self-air-cooled in such a way that air is drawn up through a vent pipe and circulated through the motor and expelled from the front of the motor. The unit shall be ILG or equal, so constructed as to keep the motor under ideal operating conditions and prevent "slow roasting", intrusion of dust, dirt, etc. The motor shall be of suitable size and speed to operate the fan to its specified capacity. All unit heaters shall be quiet in operation at all times (see subparagraph i below).

f. Diffuser. - Each unit heater shall be provided with an adjustable type diffuser designed to distribute the air in a manner to prevent objectionable drafts.

g. Control. - (1) Thermostat control of the heat delivered by the unit heaters shall be effected through the demand of room thermostats upon the unit heater motors as indicated on the drawings.

(2) Manual switches. - In addition to the automatic controls, there shall be installed for each unit heater a manual switch with thermal overload protection for the motor as indicated on the drawings. These switches shall be similar and equal to General Electric Company's Type CR-1061-C1A with suitable heaters.

(3) Aquastats. - An aquastat (see Paragraph TP11-4) shall be installed on each unit heater.

(4) Electrical connections. - A complete electric wiring diagram of the arrangement of unit heater control, showing and identifying each item of switching, protective and control equipment, shall be submitted to the Contracting Officer for approval.

h. Excess capacity. - Where the B.T.U. output capacity of any unit furnished is in excess of 125 per cent of that required, the Contractor shall install in the steam supply connection to same a suitable orifice plate for limiting the output capacity to the above figure.

i. Acceptance. - (1) All unit heaters, controls, etc. shall meet the approval of the Contracting Officer. If any or all of the unit heaters are found to be objectionably noisy after the installation is completed, the Contractor shall, at the discretion of the Contracting Officer, remove them and furnish and install other unit heaters which are satisfactorily quiet.

(2) If any support or piping is found to cause or permit vibration or objectionable noise, the Contractor shall make all adjustments or rearrangements necessary to correct such condition to the satisfaction of the Contracting Officer and at no additional expense to the Government.

TP11-4. CONTROL EQUIPMENT. - a. General. - Temperature regulation in the heated space shall be effected by the demand of room thermostats upon the unit heater motors as indicated on the drawings. Unit heaters shall be equipped with aquastats wired for reverse action to prevent the operation of the unit heater motor when there is not sufficient temperature in the heating coil to guarantee against the circulation of cold air. Operation of the oil burner shall be controlled by means of a pressurestat arranged and adjusted to maintain a fairly constant steam pressure within the boiler. The pressurestat, installed on the boiler, shall operate in conjunction with a stack switch and combination boiler water feeder and low water cut-out.

b. Room thermostats shall be of sturdy design, of a lock type, and equipped with a thermometer. They shall be designed to operate in a two degree F. differential, over a temperature range from 40 to 80 degrees F.

c. Aquastats shall be of the mercury switch type actuated by a bi-metal thermostatic element. They shall be designed to operate on approximately a 10-degree F. differential over a temperature range from 140 degrees to 240 degrees and shall be suitable for surface mounting on the return pipe from the unit heater. Aquastats shall be wired for reverse action and shall make contact on a temperature rise.

d. The pressurestat shall be of sturdy construction, thoroughly protected from dust and dampness, with the pressure elements in direct contact with the steam. It shall be designed to operate on a one-pound differential over a pressure range from 0 to 10 pounds per square inch gage.

e. The stack switch shall be a complete safety combustion control for intermittent ignition oil burners. It shall be designed to open the circuit after the flame has been established, to automatically recycle in case of power or flame failure or low voltage, and to automatically lock out in case of flame failure after one recycling operation. The unit shall have a simple adjustment to control ignition-timing and scavenger period.

f. The combination boiler water feeder and low water cut-out shall be arranged to automatically feed water to the boiler when the boiler water level drops below a predetermined point and to automatically open the oil burner circuit and ring an alarm bell should the water level reach the low danger point. The boiler feeder mechanism shall be so constructed that the feed water valve and seat will be isolated from the float chamber, thereby preventing the overheating of the feed water

and the consequent precipitation of scale on the valve or seat. The float, valve, and seat shall be constructed of durable corrosion-resistant alloy and the valve seat shall be renewable and removable. The device shall be equipped with a large self-cleaning strainer and a straight-through type drain valve. The low water cut-out shall be listed by the Underwriters' Laboratories, Inc.

g. Control equipment shall be similar and equal to the following:

Name	Description and Model Number	Manufactured by
Room Thermostats	T 42 A	Minneapolis-Honeywell
Aquastats	IA 409 B	" "
Pressurestat	P404A Pressuretrol	" "
Stack Switch	R117 A Protectorelay	" "
Combination Boiler Water Feeder a nd Cut-out	No. 47-2	McDonnell & Miller

TP11-5. SMOKE CONNECTIONS. - a. The boiler shall be connected to the flue by means of a smoke connection constructed of not lighter than No. 18 U. S. Standard gage galvanized iron or steel sheets. All iron sheets shall be true to form, free from laminations, laps, blisters, ragged edges or corners, or other defects which might affect their appearance or serviceability.

b. Suitable cleanouts shall be provided for cleaning the entire smoke connection without dismantling. Cleanout doors shall be provided with suitable hinges and clamps and with necessary gasket material for making a gas-tight joint.

TP11-6. DRAFT CONTROL. - The Contractor shall install in the smoke connection an approved barometric type draft regulator for the purpose of controlling and maintaining a constant draft in the boiler fire box, regardless of changing atmospheric conditions. The area of the opening in the draft regulator shall be not less than the area of the smoke connection.

TP11-7. BOILER CONNECTIONS. - a. Supply header. - The Contractor shall install a supply (steam) header on the boiler. All boiler outlets shall be connected by means of full-size pipes to the header, without the use of any reducers or bushings. The supply header shall be one pipe size larger than the boiler outlets and shall be properly flanged for expansion and contraction.

b. Return (Hartford loop) connection. - The Contractor shall install a complete Hartford return connection at the back of the boiler and connect the returns from the building to same as shown on the drawings or as directed by the Contracting Officer. All return openings to the boiler shall be interconnected by means of full-size pipes without the use of any reducers or bushings.

c. Cold water connection. - The cold water connection to the boiler shall be made by means of wrought iron pipe and malleable iron fittings. The line shall be run to the boiler through a gate valve, strainer, check valve, and boiler water feeder, the last being nearest the boiler. Provision shall be made for by-passing the boiler water feeder to permit feeding the boiler manually. The connections shall be adequate for makeup and for filling the system, and the entire assembly shall meet the approval of the Contracting Officer.

d. Drains. - Drains consisting of 3/4-inch hose bibbs shall be installed at low points in the system and elsewhere as required by the Contracting Officer for the convenient and thorough draining of the system.

TP11-8. BOILER TRIM. - a. General. - The boiler shall be supplied with a pressure gage, safety valve, gage glass, and compression cocks.

b. The pressure gage shall be of an approved Bourdon spring type with a minimum dial diameter of 3-1/2 inches and pressure range of minus 30 inches of mercury to 15 pounds per square inch. The gage shall be installed in such a manner as to be accessible and easily read. The gage shall be equipped with either an integral or separate syphon, and shall be connected to the boiler by means of brass pipe and fittings containing a shut-off cock.

c. The safety valve shall be of the pop type set to open automatically and relieve steam at a gage pressure of 15 pounds per square inch. Safety valves shall comply with the latest requirements of the A.S.M.E. Boiler Construction Code.

TP11-9. PIPE AND FITTINGS. - a. Pipe. - All pipe not otherwise herein specified shall be standard weight uncoated wrought iron pipe.

b. Fittings. - Fittings shall be standard weight galvanized cast-iron fittings designed for 150 pounds per square inch working pressure. Reducing fittings shall be bushed in the sand as bushings are prohibited.

TP11-10. PIPING DETAILS. - a. General. - All pipes shall be cut accurately to measurements established at the pumping station by the Contractor and shall be worked into place without springing or forcing and out of the way of windows, doors, or other openings. Excessive cutting or weakening of the building structure to facilitate piping installation will not be permitted. All pipes, after having been cut, shall have all burrs removed by reaming. All changes in direction shall be made with fittings, except that bending of 2-inch and smaller pipe will be permitted, provided that a hydraulic pipe bender is used. Bent pipe showing kinks, wrinkles, or other malformations will not be acceptable.

b. Steam mains. - All horizontal mains, unless otherwise

indicated on the drawings, shall pitch down in direction of flow with a grade of not less than 1 inch in 40 feet. Provision shall be made at risers and at the end of each main for the proper drainage of condensate through a float and thermostatic trap. In no case shall the end of a steam main be drained through a unit heater. Any change in supply main sizes shall be made through eccentric reducing fittings.

c. Branch connections. - All branches shall be taken from the top of the supply mains at an angle of 45 degrees above the horizontal. Branches from return mains shall be taken from the top or side; branches to unit heaters shall pitch up from the mains toward the unit with a grade of not less than 1 inch in 10 feet. All connections shall be carefully made to insure noiseless and unrestricted circulation, eliminate water pockets and air pockets, and permit the complete drainage of the system.

d. Joints. - All threaded joints shall be made with taper threads properly cut, and made perfectly tight by the use of a stiff mixture of graphite and oil, applied with a brush to the pipe thread only, and in no case to the fitting. All flanged joints shall be faced true, packed, and made up perfectly square and tight.

e. Expansion of pipe. - All pipe shall be so installed that it may contract or expand freely without damage to any other work or injury to itself.

f. Capping of pipe. - All open ends of pipe lines and equipment shall be properly capped or plugged during installation in order to keep dirt or other foreign material out of the system.

g. Pipe supports. - All horizontal runs of pipe shall be securely supported. Suspended pipe shall be supported on Clevis or equal hangers. Chain or flat steel hangers will not be acceptable. Pipes two inches in diameter or less that are supported from side walls shall have expansion hook plates, while larger sizes shall have brackets and roller supports. All supports shall be capable of screw adjustment after erection of pipe. Hanger rods shall be fastened to concrete by means of concrete inserts. For pipes 3/4 inch to 2 inches, inclusive, hanger rods shall be 3/8 inch diameter; for 2-1/2 to 3-1/2 inch, inclusive, rods shall be 1/2 inch diameter. Pipe supports shall be spaced not more than 10 feet on centers.

h. Pipe sleeves. - All pipes passing through floors or walls shall be fitted with wrought iron pipe sleeves and floor, wall, or ceiling plates. Sleeves shall be two pipe sizes larger than the passing pipe. The space between pipe and sleeve shall be properly caulked with graphite packing and approved plastic and waterproof caulking compound. Floor, wall, or ceiling plates shall be of nickel-plated steel of approved design.

TP11-11, FLOAT AND THERMOSTATIC TRAPS. - The Contractor shall install,

where indicated on the drawings or where specified, combined float and thermostatic traps designed for a steam working pressure of 15 pounds per square inch gauge and an operating pressure of approximately 5 pounds per square inch gauge. Traps shall have a capacity of not less than 200 pounds of condensate per hour based on a pressure differential of 2 pounds per square inch. Traps shall be provided with a hard bronze valve seat and mechanism and brass float, all of which shall be easily removable for inspection or replacement without disturbing the piping connections. A suitable brass strainer shall be provided at the inlet to each trap. The strainer may be either an integral part of the trap or separate and installed in the pipe line on the suction side of the trap. Traps shall be installed as indicated in detail on the drawings, shall be standard catalog products of reputable make, and shall meet the approval of the Contracting Officer.

TP11-12. AIR VALVES. - The Contractor shall install approved 3/4-inch quick-venting float-and-vacuum air valves on each unit heater return, at the low end of each dry-return main where it drops to the wet-return, and elsewhere as indicated on the drawings or where necessary to properly vent the system. Each valve shall have a large port to permit expelling the air without developing excessive back-pressure, a non-collapsible metal float which shall close the valve and prevent the loss of water from the system, an air seal which shall effectively close and prevent the re-entry of air into the system when sub-atmospheric pressure prevails therein, and a thermostatic member which shall close the port against the passage of steam from the system. The valves shall be designed for a steam working pressure of 10 pounds per square inch gauge. The valves shall be installed at the upper end of a 3/4-inch pipe taken from the top of a horizontal section of main and not closer than 12 inches from the down-turned elbow where the dry-return drops to the wet return.

TP11-13. VALVES. - a. Gate and globe valves. - Gate valves shall be used throughout unless otherwise shown on the drawings. Gate valves shall be of brass or bronze of the solid wedge, rising stem type. Gate valves larger than 2 inches shall be outside screw and yoke type. Globe valves shall be of brass or bronze with elastic discs and rising stems. The working pressure and manufacturer's name shall be stamped or cast on each valve body. All stuffing boxes shall have packing glands. All valves shall be installed with their stems or spindles above the horizontal.

b. Check valves. - Horizontal swing check valves shall be installed where shown on the drawings. Check valves shall be of the same manufacture as the gate and globe valves.

TP11-14. STRAINERS. - The Contractor shall install where indicated on the drawings or where specified basket or "Y" type strainers of the same size as the pipe lines in which they are installed. Strainers shall have arrows clearly cast on the sides to indicate the direction of flow, shall be constructed of brass or bronze, and shall be equipped with an easily removable cover and sediment basket. The strainer shall have a net free area through the basket of at least four times that of the entering pipe.

TP11-15. PIPE COVERING. - All supply and return piping shall be insulated with standard thickness sectional pipe covering of 85 per cent magnesia with canvas finish. Pipe covering shall be held in place with 3/4-inch wide brass straps spaced to hold the ends and center of each section. In no case shall the spacing exceed 18 inches. Valves and fittings, except unions, shall be covered with 85 per cent magnesia plaster of the same thickness as the pipe covering. All plastic insulation shall be covered with cotton sheeting neatly pasted on.

TP11-16. PAINTING. - All pipe and fittings to be covered or concealed shall be thoroughly cleaned and given one heavy coat of best quality asphaltum varnish. All pipe insulation shall be sized and painted with two coats of paint as selected by the Contracting Officer. All pipe hangers, supports, and other exposed iron work shall be given two coats of approved enamel as selected by the Contracting Officer. All painting shall conform to applicable portions of Section XVII of these specifications.

TP11-17. FUEL TANK AND PIPING. - a. The Contractor shall relocate and convert the existing 1000-gallon storage tank to a fuel oil storage tank complete with piping, sleeves, anchor bolts and accessories as shown on the drawings.

b. The tank is located adjacent to the north wall of the existing temporary pumping station and has approximately two feet of earth cover over it. The tank shall be drained of all gasoline and thoroughly cleaned. All paint shall be removed from the exterior of the tank and the metal thoroughly cleaned of scale and rust. It shall be given one coat of red lead and two coats of Detroit Graphite Company Iron-Gard paint for underwater steel structures. The existing layout of wrought-iron pipe and the fittings shall be revised subject to the inspection and approval of the Contracting Officer. The Contractor shall furnish and install one lock type fill box on the existing gage well pipe.

c. All piping outside the pumping station shall be wrought iron pipe. Fittings shall be malleable iron screw type fittings. The suction line inside the building shall be in accordance with Federal Specification WW-T-799, 3/8 inch (1/2-inch O.D.), Type K, soft-annealed copper tubing and shall be fitted with a Ryan fusible valve (or equal) at the burner. The return line inside the building shall be of similar material. A gate valve shall be inserted in the line to shut off the flow of oil from the tank.

d. Unless otherwise specified, all fuel oil piping materials, workmanship and tests shall conform to the current standard rules, regulations, and specifications of the National Board of Fire Underwriters, Chicago, Illinois and legal requirements of the City of Hartford.

TP11-18. TESTS. - a. Hydrostatic tests. - Before the boiler jacket or pipe covering is installed, the heating system shall be tested hydrostatically, at a time directed by the Contracting Officer, and proven tight under a gage pressure of 40 pounds per square inch.

b. Operating test. - Before the installation is accepted, the Contractor shall conduct a regular working test on the heating system at a time directed by the Contracting Officer. The test shall cover a period of not less than six hours. The Contractor shall furnish all labor and instruments and necessary fuel, water, and electricity for this test. The test shall show a free and equal circulation of steam to and condensate from each heating surface with all mechanical and electrical equipment functioning to the entire satisfaction of the Contracting Officer.

TP11-19. CLEANING AND ADJUSTING. - At the completion of all work and tests, all parts of the installation shall be thoroughly cleaned. The accumulation of oil and grease in the boiler shall be removed by blowing it off, through suitable surface blow-off connections, while under steam pressure. This process shall be repeated a sufficient number of times to effect the result that the boilers shall generate steam properly and continuously, and shall maintain a reasonably steady water line. As a final operation, the Contractor shall bring the pressure to about 10 pounds, draw the fire, and drain the boiler completely. After the boiler has cooled, it shall be flushed out several times and refilled to the proper operating level. The use of soda, or any alkali, vinegar or any acid will not be permitted. All equipment, pipe, valves, strainers, and fittings shall be cleaned of grease, metal cuttings, etc., and sludge which may have accumulated during testing.

TP11-20. VENTILATING EQUIPMENT. - a. Engine room ventilation. - The engine room shall be ventilated by two ventilating fans located in the roof as shown on the drawings. Fans shall be similar and equal to the No. 22, Construction "D", Design N. T. Hyduty Davidson Fan with self-acting louvers, driven by a single speed, 220-volt, three-phase, 60-cycle motor and a door starter. The fan shall have a capacity of 4435 cubic feet of standard air per minute. The motor shall be protected by a thermal overload device which is self-setting.

b. Pump room ventilation. - The pump room shall be ventilated by a blower located on the engine room floor with an air intake direct through the floor to the pump room and a discharge duct through the outside wall as shown on the drawings. The blower shall be similar and equal to an ILG B 21 type "B" volume blower direct-connected to a 110-volt, single-phase, 60-cycle motor. The blower shall have a capacity of 2000 C.F.M. at 1/4 inch S.P. The motor shall have a thermal overload starting switch similar and equal to General Electric Company's Type CR 1061-C1A located on the engine room wall, 4 feet 6 inches above the floor. Duct work shall be constructed of 20-gage galvanized iron sheet metal properly reinforced and supported and arranged as shown on the drawings.

c. Screening room ventilation. - The screening room shall be ventilated by a blower located in the lavatory with an air intake through the outside wall and a discharge duct through the floor into the screening room as indicated on the drawings. The blower shall be an ILG No. 20P direct-connected to a 110-volt, single-phase, 60-cycle motor. The

blower shall have a capacity of 500 C.F.M. at 2 inches stetic pressure. The motor shall have a thermal overload starting switch similar and equal to General Electric Company's Type CR 1061-C1A located on the wall adjacent to the blower 4 feet 6 inches above the floor. Ductwork shall be of 16-gage black iron sheet metal properly reinforced and supported and arranged as shown on the drawings.

d. Painting shall be as specified in Paragraph TP17-4 b.

TP11-21. ELECTRICAL WORK. - All the automatic control, switching, starting, protective devices, and wiring, including all materials up to either a junction box or disconnect switch located in the vicinity of the equipment, required for the operation of equipment described in this section of the specifications shall be installed and connected by the Contractor in compliance with all applicable requirements set forth in Section XII.

TP11-22. OPTIONAL EQUIPMENT. - Heating and ventilating equipment differing from that specified may be submitted, provided the Contractor clearly states such differences and all requirements and guarantees incorporated in these specifications are clearly adhered to. If the equipment offered is, in the opinion of the Contracting Officer, equal to or better than that specified, same will be given consideration for installation. When no statement of such departure is made, it will be understood that equipment in strict accordance with the specifications is being furnished.

TP11-23. GUARANTEE. - a. The Contractor shall guarantee all materials and equipment furnished and installed by him to be free from defects and capable of performing at manufacturer's maximum established rating.

b. The Contractor shall replace any part, or parts, or equipment as a whole, furnished and installed by him, found to be defective or incapable of performing at maximum established rating, within the period of guarantee without additional expense to the Government.

c. The period of guarantee shall extend for one year from the date of acceptance of the work.

TP11-24. PAYMENT. - Payment for furnishing, installing and placing in operation the heating and ventilating equipment, complete, including all control devices and wiring of same will be made at the contract price for Item 16 "Heating and Ventilating Equipment".

SECTION XII. ELECTRIC LIGHT AND POWER SYSTEM (Item 17)

TP12-1. WORK INCLUDED. - a. The Contractor shall install, complete and ready for operation, all material, equipment and wiring for the electric light and power system of the pumping station as indicated on the drawings and as required by these specifications. The Contractor shall remove transformers in the transformer substation in the Potter Street Pumping Station, and furnish and install transformers of increased capacity, remove temporary pole and overhead service wires between Potter Street and Keeney Lane Pumping Stations, install a new incoming service to Keeney Lane Pumping Station, extend the existing underground duct system, and shall make all necessary connections to the switchboard, gasoline-driven electric generating unit, all pump motors, motor-operated gate hoists, etc., and shall furnish and install all wiring, conduits, outlets, lighting fixtures, lamps, floodlight, lighting panelboard, control equipment, fittings, and junction boxes.

b. Within 60 days after the date of receipt by him of notice to proceed, the Contractor shall submit to the Contracting Officer, for approval and for the purpose of making dimensioned conduit layouts, detailed dimensioned drawings and data descriptive of all equipment powered by an electric motor, switchboard and all its equipment, controls, lighting distribution panelboard, floodlight, lighting fixtures, conduits, wire and accessories which he proposes to install. After all the drawings involving conduit connections to equipment are approved, the Contracting Officer will prepare a dimensioned conduit layout of the engine room floor slab only for the Contractor's use. No floor slab with embedded conduits shall be placed until the Contractor has received a final conduit layout from the Contracting Officer. The Contractor will be held responsible for any delay in placing of the floor slab with embedded conduits, should he fail to submit equipment data within the time specified above.

TP12-2. GENERAL DESCRIPTION. - a. The complete power system includes the changes in the transformer substation in the Potter Street Pumping Station, a new underground incoming service between Potter Street and Keeney Lane Pumping Stations, metering facilities, control equipment, switchboard, generator circuit, motor circuits, conduit, wire, and grounding system.

b. The lighting system includes the lighting panelboard, lighting fixtures, floodlight, switches, receptacles, lamps, conduits, and wire for the lighting system.

c. The battery-charging system includes conduit and wiring from the switchboard to the various batteries.

d. Keeney Lane Pumping Station will normally be supplied with electrical energy at 115/230 volts, three-phase, four-wire, 60 cycles, a. c. from a 25-Kva transformer substation in the Potter Street Pumping Station which is approximately 40 feet from the Keeney Lane Pumping Station. The Contractor shall install all material and equipment required for changes to this transformer substation as specified in Paragraph TP12-2 f. The Contractor shall install a new underground feeder in conduit as specified in Paragraph TP12-5 b from the switchboard in Keeney Lane Pumping Station to the transformer substation in the Potter Street Pumping Station. A standby gasoline engine-driven generator will supply power to the pumping station in case of an interruption of the normal source of power supply.

e. The electrical equipment throughout shall be especially designed for wet or damp locations as herein specified.

f. Changes to existing facilities. - (1) At the transformer substation in the Potter Street Pumping Station, the Contractor shall remove and turn over to the Government at the site the two existing 5-Kva transformers and shall furnish and install in their place one 15-Kva and one 10-Kva, 2400-240/120-volt, single-phase, 60-cycle transformer "T" connected on the secondary side to supply 115/230-volt, three-phase, four-wire, 60-cycle, A. C. power to Keeney Lane Pumping Station. For description of transformers see Paragraph TP12-11 a.

(2) The primary fuse cutouts shall be re-fused to allow 50 per cent overload on the new transformers.

(3) The fuses in the secondary service switch shall be changed to 100-ampere capacity.

(4) During the course of construction of the addition to the existing pumping station, the Contractor shall remove the two remote push button stations now located in the existing pumping station and mount them on the pole adjacent to the handhole shown on the drawings. These two push button stations which control existing gate hoists beyond the dike shall later be reinstalled in the permanent station by the Contractor.

g. Removal of existing facilities. - (1) The Contractor shall remove all temporary services to the existing Keeney Lane Pumping Station. This includes the overhead single-phase, three-wire lighting service, overhead three-phase service for the gate hoists, pole, conduit on pole, secondary racks, wire, and the temporary wiring in the 2-inch conduit from the secondary service switch to the secondary rack at Potter Street Pumping Station.

(2) The Contractor shall remove from the existing Keeney Lane Pumping Station the incoming switch, panelboard and battery charger. This work shall be done as directed by the Contracting Officer.

(3) All materials removed will remain the property of the Government and shall be turned over to the Contracting Officer.

h. The Contractor shall install the underground duct and hand-hole system shown on the drawings and as specified in Paragraph TP12-5 c.

i. The Contractor shall provide for future metering of the incoming power to the station. This shall include a main fused service switch and meter trough but no meter. (See Paragraph TP12-11 c (2).)

TP12-3. STANDARD RULES AND SPECIFICATIONS. - a. Unless otherwise specified, all electrical equipment and materials, workmanship and tests shall conform with the current standard rules, regulations, and specifications of the following authorities:

(1) American Institute of Electrical Engineers, 33 West 39th Street, New York, N. Y.

(2) National Board of Fire Underwriters, National Electrical Code, 85 John Street, New York, N. Y.

(3) National Electrical Manufacturers Association, 155 East 44th Street, New York, N. Y.

(4) Bureau of Standards, National Electrical Safety Code, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

(5) Insulated Power Cable Engineers Association, 420 Lexington Avenue, New York, N. Y.

(6) Federal Specifications cited herein (Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.)

(7) The Hartford Electric Light Company, Hartford, Connecticut.

b. Copies of these rules, regulations, and specifications may be procured at the addresses as given, or may be seen at the Corps of Engineers, Boston, Mass.

TP12-4. CONDUITS. - a. Conduits shall be located approximately as indicated on the drawings.

b. The conduits shall be hot-dip galvanized or sherardized on both inside and outside, and shall meet the requirements of Federal Specification WW-C-581a for "Conduit; Steel, Zinc-coated". Conduit fittings or bodies shall be galvanized, sherardized or cadmium-plated high-test gray iron castings or malleable iron, of the types and sizes specified, shown on the drawings, or required. The material shall

be approved by the National Board of Fire Underwriters, and the conduit fittir · shall be similar and equal in all respects to those manufactured by the Crouse-Hinds Company. Conduit sizes shall meet the requirements of Article 346 of the 1947 edition of the National Electrical Code with the exception that no conduits smaller than 3/4 inch shall be used.

c. · The installation of conduits shall comply with Article 346 of the 1947 edition of the National Electrical Code. All wire and cables shall be run in rigid conduits forming a complete raceway from the cabinet or panel to the last outlet in the system. Conduits shall be run concealed or run exposed as indicated on the drawings. Conduits in masonry walls and floors shall be built-in complete with all necessary fittings at the time the masonry is being placed. All exposed conduits shall be securely fastened and anchored to the structural portions of the building and shall be run parallel with or at right angles to the walls. All conduits shall be run with long radius bends where possible, and not more than the equivalent of four 90 degree bends shall be used on any run. If more than four bends are required, pull boxes shall be installed at points approved by the Contracting Officer. As soon as possible after the concrete has set, each conduit shall be cleaned, inspected, and tested by the Contractor to ascertain its mechanical and electrical continuity, and freedom from obstructions. Any defects in material or workmanship shall be remedied immediately as directed by the Contracting Officer. After each duct line is completed, the Contractor shall inspect and test the conduit as directed and the conduit ends shall be capped with pipe caps.

TP12-5. WIRING. - a. The Contractor shall install all wire and cable, terminals, junction boxes, supports, hangers and make all connections to equipment. All wiring shall be in rigid conduit unless otherwise specified or shown on the drawings.

b. The Contractor shall install, underground, the 2-inch incoming service conduit from Potter Street Pumping Station to Keeney Lane Pumping Station. This conduit shall be buried a minimum depth of 2 feet 6 inches below finished grade and shall have a minimum of 3-inch thick concrete envelope on the top, bottom and sides. At the Potter Street Pumping Station the 2-inch conduit shall be installed up the side of the building to the new 18 x 12 x 10-inch junction box located approximately 28 feet above grade. The completion of this work will form a continuous conduit system from the switchboard through the metering equipment in Keeney Lane Pumping Station to the secondary switch in the Potter Street Pumping Station. In this complete conduit system there shall be installed a No. 4 A.W.G., four conductor, 600-volt, type RHL cable. The ends of the cable shall be sealed by building up an insulated cone with rubber and insulating tape at the end of the cable and covering the cone with insulating varnish. The cable from the secondary switch in the Potter Street Pumping Station to the metering equipment in the Keeney Lane Pumping Station shall be one continuous run without splices.

c. The Contractor shall complete the duct line and handhole system from the existing handhole system from the existing handhole into the station. The new concrete handhole and duct line extension adjacent to the pumping station shall be at the location and of the size as indicated on the drawing. The Contractor shall remove the existing two (2) three (3) conductor #8 power and two (2) twelve (12) conductor, #16 control cables between the existing handhole at the pumping station and the hoist motor control switches at the gate house structures, and shall replace them by two (2) three (3) conductor, #8 AWG, RHL, 600 volt power cables and two (2) twelve (12) conductor, #16 AWG, RHL, 600 volt control cables. These new cables shall not terminate at the existing handhole but shall be continued without splice through the new duct line extension and new handhole into the pumping station, the two (2) power cables terminating at the switchboard and the two (2) control cables at the outdoor gate hoist controls. Distance from existing handhole to gate house structures is approximately 300 feet. Each cable shall be installed in a separate duct of the duct system.

d. All wire used shall be copper, soft drawn and annealed, having not less than 95 per cent conductivity. Wire sizes shall comply with Article 300 of the 1947 edition of the National Electrical Code, except that no wire shall be used that is smaller than No. 12 A.W.G. All wire and cable used for power circuits of 208 volts and above, except as otherwise shown on the drawings, or herein specified, shall be RHL and shall conform to Federal Specification J-C-103 for "Cable and Wire, Rubber-Insulated, Building Type (0-5000 volt service)". All wire and cable used for power and control circuits of 120 volts and under, and all lighting circuits, except as otherwise shown on the drawings, shall be type RW and shall conform to Federal Specification J-C-103 for "Cable and Wire, Rubber-Insulated, Building Type (0-5000 volt service)".

e. All wire and cable shall be shipped on reels or in coils, plainly marked for complete identification, including the wire or cable size, number of conductors, length, weight, insulation thickness, character of the insulation, and the name of the manufacturer.

f. Materials used in the wiring shall conform to the following requirements:

(1) Solder for splicing or wiping shall conform to Federal Specification QQ-S-571a, for "Solder; Tin-Lead", Class A for sweat conductor joints.

(2) Solder for brazing shall conform to Federal Specification QQ-S-551, for "Solder; Brazing", Composition B.

(3) Silver solder shall conform to Federal Specification QQ-S-561c for "Solder; Silver", Class O.

(4) Rubber tape shall conform to Federal Specification HH-T-111b for "Tape; Rubber Insulating".

(5) Friction tape shall conform to Federal Specification HH-T-101e for "Tape; Friction", Grade "A".

(6) Cotton tape shall conform to United States Navy Department Specifications 17-T-156 for "Tape; Insulating, Linen Finish, Plain", thickness .007 inch.

g. The following wire and conduit schedule shall be used for this station:

Circuit	From	To	Number of Conductors	Conductor Type & Size	Conduit Size
Incoming	Potter Street Station	Keeney Lane Station	1-4/C	No. 4 RHL	2"
Incoming	Meter Switch	Switchboard	1-4/C	No. 4 RHL	2"
Generator	Generator	Switchboard	1-4/C	No. 4 RHL	2"
Exciter	Generator	Switchboard	1-4/C	No. 12 RHL	1"
Gate Hoist	Switchboard	Hoist No. 1	1-3/C	No. 12 RHL	1-1/2" &1"
Gate Hoist	Switchboard	Hoist No. 2	1-3/C	No. 12 RHL	1-1/2" &1"
Gate Hoist	Switchboard	Hoist No. 3	1-3/C	No. 12 RHL	1-1/2" &1"
Gate Hoists at dike	Switchboard	Gate Hoist motor control switch	2-3/C	No. 8) see	2"
Gate Hoists at dike	Outdoor Gate Hoist Controls	Gate Hoist motor control switch	2-12/C	No. 16) subparagraph) TP12-5c.	
Centrifugal Pump	Switchboard	Pump	3-1/C	No. 12 RW	3/4"
Bar Screen Motor	Switchboard	Bar screen motor	2-3/C	No. 12 RHL	1-1/4" & 1"
Roof vent motor	Switchboard	Roof vent motors	2-3/C	No. 12 RHL	1-1/4" & 1"
Panelboard	Switchboard	Panelboard	1-3/C	No. 6 RHL	1-1/4"
Battery Charger	Switchboard	Batteries	6-1/C	No. 12 RW	1-1/4" & 1"
Lighting & 1 phase power	Panelboard	Lighting & small motors	1/C as required	No. 12 RW	-
Ground	Switchboard	Generator	1-1/C	No. 4 bare, strd.	1"
Ground	Switchboard	Water service pipe	1-1/C	No. 4 bare, strd.	1"

h. All electric controls, switching and protective devices and electrical accessories required for the proper operation of the heating and ventilating system and all wiring required to connect these systems to an adjacent junction box shall be furnished and installed as specified in Section XI.

TP12-6. GROUNDING. - Permanent and effective ground connections shall be provided for the neutral of power supply, generator, switchboard, all metal cabinets enclosing electrical equipment, equipment frames and housings, continuous runs of metal conduit, and elsewhere to comply with Article 250 of the National Electrical Code, as shown on the drawings, and as specified or directed by the Contracting Officer.

The contact area of all joints in grounding circuits shall provide a current carrying capacity not less than that of the connecting wire or cable, and the joints shall be bolted or brazed, as specified or as directed. All ground connections to equipment that may require removal for maintenance or repair shall be bolted to the equipment. The switchboard shall be grounded at only one point. All conduit at the switchboard shall be bonded together with a No. 6 copper cable using standard grounding bushings for this purpose. A ground wire shall be installed in the ground circuit from the switchboard to the cold water service.

TP12-7. LIGHTING AND OUTLETS. - a. The lighting panelboard, fixtures, plug receptacles, tumbler switches, lamps and outlet boxes shall be installed as specified and at locations indicated on the drawings and shall be in accordance with the description as shown on the Bill of Material. The complete electrical installation in the screening room shall be explosion-proof.

b. Lamps, including those for floodlight, shall be rated at 115 volts and of the watt rating shown or specified and shall conform to Federal Specification W-L-101c for "Lamps; Electric, Incandescent, Large, Tungsten-Filament".

c. All lighting fixtures shall be installed as specified and at locations indicated on the drawings and shall be similar and equal to those specified in the Bill of Material. All fixtures shall be installed at locations as shown and conduit shall be run in the structural portion of the concrete slab as shown on the drawings.

d. One floodlight shall be located on the roof parapet as shown on the drawings and shall be made adjustable so that the dike will be well-lighted. It shall be similar and equal to Crouse-Hinds Company ADE-16 Catalog No. 42932 equipped with a narrow beam, polished, Alzak reflector and a plain lens. The lamp for the floodlight shall be type PS-52 rated at 1000 watts, 115 volts, 60 cycles, A.C. It shall have a standard type mounting and be fitted with a locking handle and adjustable horizontal stops.

e. The fixtures on the front of the pumping station shall be Hurlin Manufacturing Co., Philadelphia, Pa., Catalog No. 1796 or equal. The fixtures shall be attached to the pumping station by the brackets supplied with the fixtures as directed by the Contracting Officer. The outlet box shall not be used as a means of supporting the fixture. The complete installation shall be watertight.

f. All sockets, switches, and receptacles shall be National Electrical Code Standard and shall be in accord with the description as shown on the Bill of Material.

g. The lighting panelboard shall be arranged for 230-115 volts, single phase, three wire service with 100-ampere main lugs and with fourteen single pole, 15-ampere, 250-volt and two double pole, 15-ampere, 250-volt automatic circuit breakers. The panelboard shall

be flush mounted and conform to Federal Specification WW-P-131a for "Panelboards; Equipped with Automatic-Circuit-Breakers", except that the name plate shall be phenolic compound with engraved white enamel filled letters. The name plates shall be marked as directed by the Contracting Officer. The panelbard shall have side gutters of uniform width on four sides and ample dimensions to accommodate branch circuits and incoming feeders. The panelboard shall have doors with concealed hinges and shall be thoroughly rust-proofed and finished in black lacquer. It shall be similar and equal to the "No-fuse Safety Panelboards" as manufactured by the Westinghouse Electric Corporation.

TP12-8. SWITCHBOARD. - a. The Contractor shall install in the engine room at the location shown on the drawings a two-panel, free-standing, safety, steel-enclosed, dead-front type switchboard. This switchboard shall provide electric power control for the entire pumping station.

b. Facing the switchboard from the front the panels left to right shall be arranged in the order named below. Each panel shall control the circuits listed.

(1) Panel No. 1

Top Section

Combined generator, exciter and regulator panel for the gasoline-electric standby unit. Capacity 25 Kva at 80 per cent power factor, 208/120 volts, three-phase, four-wire, 60 cycles, A. C. with 125-volt, D. C. direct connected exciter.

Middle Section

Incoming feeder from the outside power source.

Bottom Section

Incoming feeder from the standby generator unit.

(2) Panel No. 2

Top Section

One feeder made up of five circuits to the various storage batteries.

One feeder, 115 volts, single-phase, 60-cycle, A. C. for the battery charger input.

Middle Section

Five feeders, 240 volts, 3-phase, 60 cycles, A. C. to the gate hoist motors.

Middle Section (cont'd)

Two feeders, 230 volts, 3-phase, 60 cycles, A. C. to the bar screen motors.

Two feeders, 230 volts, 3-phase, 60 cycles, A. C. to the roof vent fans.

One feeder, 230 volts, 3-phase, 60 cycles, A. C. to the centrifugal pump.

One feeder, 230 volts, single-phase, 3-wire, 60 cycles, A. C. to the lighting panelboard.

One feeder, 115 volts, single-phase, 2-wire, 60 cycles, A.C. to the trash hoist motor receptacle.

Bottom Section

Blank

c. The panels shall contain the following equipment.

(1) Panel No. 1

One voltage regulator complete with all necessary auxiliary equipment. (Voltage regulator rheostat knob shall be located on the front of the switchboard.)

One mounting for the exciter-field rheostat (furnished under Item 18, see Paragraph TP13-6).

One voltmeter, 0-300 volts, 60-cycle, A. C. with two selection switches, for reading the phase voltages and voltage to neutral of the generator and the phase voltages and voltage to neutral of the incoming line from the commercial power source complete with the necessary fuse blocks and fuses.

One wattmeter 0-25 KW which shall read the secondary power from both the "D" connected transformers and the "Y" connected generator.

One ammeter, 0-100 amperes, 60-cycle, A. C. with three current transformers, 100 to 5 amperes and a selector switch for reading the three-phase currents.

One ammeter, 0-15 amperes, D. C. for reading the generator field current.

One 60-cycle frequency meter.

Complete potential and current test blocks mounted on the front of the board.

Two 100-ampere, 600-volt, three-pole air circuit breakers with an interrupting capacity of 15,000 amperes for the 25-Kva standby generator and commercial power source each provided with three instantaneous and three time-delay magnetic overcurrent trips. Undervoltage devices shall not be used on these breakers. The two breakers shall be mechanically interlocked.

Two pilot lights, one to indicate commercial power "on" and one to indicate standby power "on". (Locate on same panel as controlling breaker)

(2) Panel No. 2

Five ammeters, 0-15 amperes, D. C., for indicating the output of the battery charger to each storage battery.

Five rheostats for varying the input current to each of the five storage batteries. These switches shall have an "off" position.

One voltmeter, 0-20 volts, D. C. for indicating the voltage of each battery separately.

One six-point voltmeter switch for switching the battery circuit to the voltmeter. One point shall be the "off" position.

One 15-ampere, 250-volt, single-pole air circuit breaker provided with a suitable thermal overload and instantaneous short-circuit trip for the incoming circuit to the battery charger.

One 25-ampere, 250-volt, double-pole air circuit breaker provided with suitable thermal overload and instantaneous short-circuit trips for the outgoing circuit from the battery charger.

Six 35-ampere, 600-volt, three-pole air circuit breakers provided with thermal overload and instantaneous short-circuit trips for the feeders to the five gate hoist motors and the centrifugal pump motor.

Two 20-ampere, 600-volt, three-pole air circuit breakers provided with thermal overload and instantaneous short-circuit trips for the feeders to two bar screen motors.

One 70-ampere, 600-volt, two-pole air circuit breaker provided with thermal overload and instantaneous short-circuit trips for the feeder to the panelboard.

Two 15-ampere, 600-volt, three pole air circuit breakers provided with thermal overload and instantaneous short circuit trips for the feeders to the two roof vent fans.

One 35-ampere, 250-volt, single-pole air circuit breaker provided with thermal overload and instantaneous short circuit trips for the feeder to the trash hoist motor receptacle.

(3) Tests blocks for current transformer secondary leads and main bus potential leads shall be furnished.

TP12-9. CONSTRUCTION OF SWITCHBOARD. - a. Panels. - The switchboard shall be of the dead-front totally enclosed type of construction conforming to standards of the NEMA. All panels shall be of 1/8-inch "Stretcher-leveled" steel with a 1/4-inch radius bevel on all front edges and of equal width. Panels shall have rolled edges. The width of the panels shall be such as to give a compact and neat arrangement of the equipment without sacrificing efficiency and accessibility in the operation and maintenance of the switchboard. The panels shall be bolted to the switchboard frame and each shall be subdivided into vertical sections which may be removed to give access to apparatus on the subpanel. The top section of Panel No. 1 shall be hinged door type with all meters, test blocks, etc., attached to the door. In other panels slots with suitable trim shall be provided to accommodate the handles of switches and breakers. There shall be provided on the front of the panel a visual indicator of the mechanical type to show the position of each switch or breaker. No gaps or wide joints shall be visible in the completed assembly. Two lifting eye bolts shall be installed in the top of the switchboard.

b. Rear cover plates. - The rear of the switchboard shall be enclosed by framed cover plates with a 1/4-inch radius bevel on outside edges, which shall run the full height of the switchboard and shall be arranged in convenient widths. The panels shall be in the form of swinging doors with locks and concealed hinges. The cover plates shall fit snugly and no gaps or wide joints shall be visible in the completed assembly.

c. Busses and wiring. - All power conductors shall be of the proper cross section for the currents to be carried and no power wire shall be smaller than No. 8 A.W.G. All control wire on the panels shall be run in wiring gutters provided on the side of the panels and shall be brought out to terminal blocks when they leave the panels. Leads to instruments on the door panel shall be extra flexible wire. All busses shall be mechanically rigid and designed to carry the rated current to the circuit with a maximum temperature rise of 30 degrees C. The buss for the neutral conductor shall be mounted on insulated supports and grounded to the frame of the switchboard at one point only. Busses shall be marked to indicate their phase connection, i.e., 1, 2, 3 and ground. Copper soldering lugs shall be provided for all breakers and outgoing circuits.

d. Fuses. - All fuses for motor circuits and control circuits shall be located at an easily accessible location.

e. Finish. - All steel work shall be Bonderized or given similar treatment, and also given a dull black marine finish.

f. Name plates. - Suitable name plates shall be attached to the switchboard for all circuits, controls and instruments. Name plates shall be black bakelite with white engraved letters. A list of all proposed name plates shall be submitted to the Contracting Office for approval.

g. Insulating mat. - A rubber insulating mat shall be furnished and placed in front of the switchboard. It shall extend the full length of the switchboard, and shall be 3/8 inch thick by 36 inches in width.

TP12-10. SWITCHBOARD EQUIPMENT. - a. Air circuit breakers for the feeders from the standby generator and the outside power source shall be three-pole, single-throw, stationary mounting, trip-free, manually-operated, rated at 600 volts, 60 cycles, A. C. and having an interrupting capacity of 15,000 amperes. The air circuit breakers for the generator feeder and for the feeder of the outside power source shall be provided with three instantaneous and three time-delay magnetic overcurrent trips and a mechanical interlock attachment on each circuit breaker. The mechanical interlock attachments shall be interconnected by a shaft acting directly on the pole shaft so that only one circuit breaker can be in a closed position at any time. A suitable switchboard trim shall be provided for these breakers.

b. Air circuit breakers for feeder protection of motors and equipment feeding from the main buss except the feeder to the trash hoist motor receptacle shall be provided with suitable thermal-overload and instantaneous short-circuit trips and shall be rated at 600 volts, 60 cycles, A. C., having an interrupting capacity of 10,000 amperes. The circuit breakers for the input and output side of the battery-charger and for the feeder to the trash hoist motor receptacle shall be provided with suitable thermal-overload and instantaneous short-circuit trips and shall be rated at 250 volts. Breakers shall have as many overload trips as there are poles.

c. Instrument switches for reading line voltage and currents shall be the rotary type similar and equal to the General Electric Company type SB-1. The voltmeter switches shall be connected to read the voltage to neutral in one phase in addition to the three-phase voltages.

d. The voltage regulator shall be designed for automatic voltage control of the generator and arranged for operation in the exciter shunt-field circuit. It shall provide good regulation up to 150 per cent of rated generator capacity and shall be similar and equal to Westinghouse Electric Corporation's Type SRA-1.

e. A battery charger of the copper-oxide type shall be installed inside the switchboard. The output side shall be connected to the battery-charging system specified in Paragraph TP12-2 c and the input side shall be capable of operating at 115 to 120 volts, 60-cycle, A. C., and shall have sufficient capacity to charge two twelve-volt batteries in parallel at a charging rate of 12 amperes each with positive terminal grounded. It shall be provided with separate adjustment in the

circuit to each battery for varying the charging rate from zero to maximum in at least 6 steps and a separate miniature rectangular ammeter to indicate the direct current output to each battery. A miniature rectangular voltmeter and a voltmeter switch shall also be provided to read the voltage across each battery. The adjustment shall be operated from the front of the switchboard. The meters shall be flush mounted on the front of the switchboard.

f. All fuses shall be readily accessible and shall comply with Federal Specification W-F-791a for "Fuses; Cartridge, Inclosed, Non-Renewable".

g. Meters shall be rectangular, semi-flush mounted, have a five-inch scale and shall be similar and equal to the corresponding product of the General Electric Company. The wattmeter shall be the three-element type to accurately read the power in unbalanced circuits. Direct current ammeters for reading the input to the batteries shall be miniature type.

TP12-11. MISCELLANEOUS EQUIPMENT AND MATERIAL. - a. Transformers. - The transformers in the Potter Street Pumping Station shall be rated 15-Kva and 10-Kva, 2400-240/120 volts, single-phase, 60-cycle and shall be provided with four 2-1/2 per cent, full Kva capacity taps in the high voltage windings, below rated voltage. For the "T" connection, the 15-Kva transformer shall be used as the main transformer and the 10-Kva as the teaser transformer. The 15-Kva transformer shall have a 50 per cent tap and the 10-Kva transformer an 86 per cent tap. The transformers shall conform to NEMA standards and shall be non-inflammable type similar and equal to General Electric Company's "Pyranol" transformers.

b. Primary fuse cutouts. - The primary fuse cutouts in the Potter Street Pumping Station shall be re-fused for the new transformer.

c. Service switches. - (1) The service switch in the secondary line in the Potter Street Pumping Station shall be re-fused with 100-ampere "fusetron" fuses.

(2) The service switch in the incoming line in Keeney Lane Pumping Station shall be a 100-ampere, 600-volt, three-pole and solid-neutral fused safety switch. Adjacent to or combined with this switch, there shall be provided a meter trough or facilities for future metering of power to the station. No metering transformers or meter shall be installed under this contract. Metering facilities shall be in accordance with the requirements of the Hartford Electric Light Company.

TP12-12. TESTS AND GUARANTEE. - Tests, required to indicate and insure the proper and desired operation of all electrical equipment, control and wiring, shall be made in the presence of the Contracting Officer or his representative. The switchboard will be inspected at the place of manufacture prior to shipment. Each circuit shall have an insulation resistance between the conductors and between conductors

and ground of not less than ten megohms. After all electrical equipment is in place and connected, the Contractor shall make a load study test of the station on both commercial and standby power and submit results of such tests in writing to the Contracting Officer. This report shall include tests on each motor individually and on the complete station with all motors in operation. The Contractor shall guarantee all materials and equipment for a period of one year from the date of final acceptance. Any defects disclosed within that period due to faulty materials and equipment shall be repaired or replaced promptly by the Contractor at no additional expense to the Government. All meters used for testing shall be furnished by the Contractor.

TP 2-13. PAYMENT. - a. Payment for the electric light and power system, complete and placed in operation, will be made at the contract price for Item 17 "Electric Light and Power System".

b. Payment for concrete handhole with coarse aggregate drain and concrete duct lines will be made at the contract unit prices for Items 7 and 9.

c. Payment for cast-iron frame and cover for handhole will be made at the contract unit price for Item 12.

d. Payment for all testing shall be included in the contract price for Item 17.

PART IV

SECTION XIII. GASOLINE-ELECTRIC STANDBY UNIT (Item 18)

TP13-1. WORK INCLUDED. - The Contractor shall install one complete and fully equipped gasoline-electric generating unit in the location shown on the drawings.

TP13-2. GENERAL DESCRIPTION. - a. The unit shall consist of a gasoline engine direct-connected through a flexible coupling to a synchronous type generator with direct-connected exciter, all mounted on a common cast iron or structural steel base. The generating unit shall supply 3-phase, 60-cycle, alternating current power at 208/120 volts with a 4-wire circuit and shall have an output rating of 25 Kva, 80 per cent power factor. A suitable exciter field rheostat shall be furnished with the generator.

b. The unit shall be equipped with a storage battery and electric starting motor, a/generator, detachable hand crank, and all other necessary appurtenances for a complete installation. battery charging

c. The unit, complete with all accessories, shall be free from objectionable vibrations within the range of 120 r.p.m. below to 120 r.p.m. above normal speed.

d. The engine fuel used in all tests shall conform to Federal Specification VV-G-101a for "Gasoline; Motor, United States Government", and shall have an octane number of 60 to 70.

TP13-3. GASOLINE ENGINE. - a. General. - The gasoline engine for the standby unit shall be the product of a reliable manufacturer who can show at least five years' experience in the successful manufacture of engines of the type specified and for similar duty. The engine shall be of the four-cycle type with four or more cylinders and shall have a published continuous rating of not less than 50 brake horsepower at 1200 r.p.m. It shall have a published continuous speed rating of not less than 1200 r.p.m. The engine shall be ruggedly constructed for heavy duty and long life. All other details of construction not specifically mentioned shall conform with standard practice.

b. Construction details. - The principal parts of the engine shall be as follows:

(1) The crankcase shall be of the pedestal base type with large side plates easily removable for inspection and adjustment of all bearings and other parts.

(2) The cylinder block shall be separate from the crankcase, and shall be cast in one piece or in pairs of cylinders. Cylinders and heads shall be fully water-jacketed.

(3) Pistons shall be of light-weight cast iron or suitable alloy, and of such construction as to provide uniform expansion of the piston skirt. Each piston shall have at least four rings, three above the piston pin and one below. Piston pins shall be made of hardened tubular steel, accurately ground and securely locked in place.

(4) The crank shaft shall be made of one piece, heat-treated alloy forging substantially designed to withstand the most severe operating conditions. It shall be dynamically and statically balanced and all journals shall be ground and polished. The crank shaft shall be drilled to provide oil feed from the pressure system to the connecting rod bearings.

(5) The camshaft shall be of high-grade, forged, heat-treated steel with integral cams.

(6) The connecting rods shall be of high-grade forged steel, properly heat-treated.

(7) Push rods shall be of hardened steel and accurately ground. Push rod guides shall be of suitable material to resist wear and heat and shall be removable.

(8) The flywheel shall be of gray iron or steel and shall be statically and dynamically balanced. It shall be constructed to withstand the maximum speed of the engine and shall be securely attached to the crank shaft on the engine side of the flexible coupling.

(9) The flexible coupling shall be of an approved type and shall be provided with a suitable guard. The coupling shall be suitable for transmitting 300 per cent of the normal operating torque of the engine.

(10) The main bearings shall be of a readily removable sleeve type and shall be accurately fitted and anchored against side thrust. Oil, under pressure, shall be suitably admitted to the inside of each main bearing shell.

(11) The valves shall be of special heat-resisting steel, of large area, accurately fitted and ground to fit the valve seats. The valve seats shall be removable and of special steel, heat-treated.

(12) A positive displacement gear driven pump shall supply oil under pressure to the main bearings, connecting rod bearings, valve operating mechanism, piston pins, and timing gears. The pump shall be accessible and removable without dismantling the engine. An oil pressure gauge shall be installed on the control board. A suitable, high grade oil filter with safety by-pass valves and an oil cooler shall be provided and installed on the engine.

(13) One carburetor equipped with choke, air filter, flame arrester, gasoline filter, drip pan, and piping shall be provided. The engine shall be equipped with an engine-driven diaphragm type gasoline pump and a hand pump suitable for pumping the gasoline from the tank to the engine. The carburetor and gasoline piping shall conform to the requirements of the Underwriters' Laboratories. Connection to gasoline line shall be made with flexible seamless bronze hose with woven wire protection and packless connections.

(14) Ignition and starting system. - (a) A 12-volt battery-distributor system and an approved magneto with an impulse coupler system shall be provided. There shall be two spark plugs in each cylinder, fired simultaneously. The ignition shall be so controlled that either type of ignition may be used by operating a switch. The starter push button switch shall consist of two single-pole contacts in tandem so arranged that the battery charging circuit is opened before the engine cranking circuit is closed. The switch shall be spring operated and shall close the battery charging contacts in its normal position. A terminal block enclosed in an outlet box and connected with No. 12 wire to the battery shall be installed on the standby unit engine to provide for connecting the battery charging leads from the battery charger on the station switchboard.

(b) A 12-volt, heavy-duty electric cranking motor shall be provided for starting the engine. The cranking motor shall be controlled by a 12-volt magnetic switch. The cranking motor shall be capable of cranking the engine at sufficient speed to insure starting. Suitable provision shall be made to prevent operation of the engine cranking motor except when the spark control lever is in full-retard position.

(c) A 12-volt storage battery shall be provided. The battery shall have sufficient capacity to provide 3-minute continuous cranking of the complete unit under operating conditions with an ambient engineroom temperature of 32 degrees F.

The battery shall have a special plate construction for severe or unusual conditions. Each positive plate shall be composed of multiple insulated containers filled with active materials, the containers to run vertically, horizontally or diagonally, permitting free passage of electrolyte from one face of the plate to the other; each container shall be slotted or perforated to permit diffusion of the acid electrolyte into the containers.

The electrolyte shall be of the low-gravity type with a specific gravity of 1.200 to 1.220.

The battery shall conform to the specifications for United States Government award by the Treasury Department, Procurement Division, Branch of Supply for lead-acid storage batteries, Class 17, Item B0630.

A suitable shelf or platform with an acid-proof rubber or lead tray shall be provided on or located adjacent to the engine base for mounting the battery.

(15) Governor. - The governor shall be of the mechanical flyball type capable of maintaining a constant engine speed under fluctuating load conditions. The difference in speed between full load and no load shall not be greater than 3 per cent of the rated operating speed of 1200 R.P.M. Maximum change in speed, when full load is applied instantaneously, shall not exceed 5 per cent of the rated operating speed of 1200 R.P.M. Governor regulating devices shall be so designed that adjustments may be made easily and accurately.

(16) Over-speed switch. - The engine shall be provided with an automatic ignition cut-out switch that will shut the engine down when the engine speed exceeds that normally controlled by the governor. The cut-out switch shall be adjustable and provided with manual reset.

(17) The exhaust manifold shall be a close-grained gray iron casting, water jacketed for its entire length, and provided with suitable flange connections having straight pipe thread for exhaust pipe. A water-cooled brass or bronze flexible exhaust shall be provided as shown on the drawings and shall be similar and equal to that manufactured by the Packless Metal Products Corporation of Long Island City, New York.

(18) An exhaust silencer for the engine shall be provided for mounting on the roof as shown on the drawings. The silencer shall be of corrosion-resistant metal and shall be similar and equal to the Model MU-2 manufactured by the Maxim Silencer Company, or the equivalent silencer manufactured by the Burgess Battery Company. The Contractor shall install two 1-inch thicknesses of insulation similar and equal to Keasby & Mattison "HY-Temp", Johns Manville "Superex" or Carey "Hi Temp" with an 8-ounce canvas jacket for exhaust pipe assembly insulation as shown on the drawings. The insulation shall be preformed in semicircular 180-degree sections. Block insulation on piping will not be acceptable. All joints shall be staggered and sealed with high temperature cement plaster. The canvas jacket shall be cut-back 2 inches from all hot metal surfaces. Where canvas jacket is cut-back, the insulation shall be covered with asbestos paper extending under the canvas and to the hot metal surfaces.

(19) Cooling system. - The engine shall be water-cooled with water obtained from the city water system. A temperature-regulated valve shall be installed in the cooling water intake to regulate the flow of cooling water through the engine. The regulator shall be equal to that manufactured by the Fulton Sylphon Company. A suitable gate valve shall be installed in the line ahead of the regulator. The Contractor shall provide a pressure-temperature operated switch so arranged that it will open the ignition circuit in the event the oil pressure is not adequate for safe operation of the engine or in the event the cooling water temperature exceeds that at which the switch is set to operate. A foot-operated switch shall be provided for use when the engine is being started to cut out the oil pressure safety switch.

TP13-4. MISCELLANEOUS EQUIPMENT. - a. Instrument panel. - A polished metal panelboard shall be installed on the engine and the following instruments and equipment mounted thereon:

1 - tachometer
1 - main oil line pressure gauge
1 - ammeter
1 - cranking motor push-button switch
2 - ignition switches
1 - temperature gauge

b. Tools. - One set of special wrenches or tools shall be provided and mounted in a suitable cabinet.

TP13-5. GENERATOR. - a. The generator shall be of the standard, rotating field, synchronous type having the rating specified in Paragraph TP13-2. When the generator is operating continuously at full rated load and voltage, the temperature rise in the cores and windings shall not exceed 50 degrees Centigrade above an ambient temperature of 40 degrees Centigrade. The generator shall conform to the standards of the American Institute of Electrical Engineers and the National Electrical Manufacturers Association. It shall be a regularly manufactured type and model of a make that has been regularly manufactured for at least 5 years.

b. The stator and rotor windings shall be insulated with Class "A" insulation and shall be specially designed to resist moisture during long periods of idleness. The armature terminals shall be located as shown on the drawings, and shall be housed in a terminal box, with a removable cover, to which conduit may be readily connected from below.

c. The generator shall be provided with two sleeve bearings of ample size. The bearings shall be of phosphor bronze or bronze and babbitt-lined, and shall be positively self-lubricated by oil rings extending into an oil reservoir.

d. Slip rings shall be of bronze or brass. Brush holders shall be marine type of rugged construction and shall be provided with an adjustable tension spring which can be adjusted while the machine is in operation and then locked in position. All ferrous materials shall be corrosion-resisting or shall be rust-proofed by a suitable process.

TP13-6. EXCITER. - The exciter shall be mounted on an extension of the generator end bracket, and shall be direct-connected to the generator. The exciter shall be shunt wound and of sufficient capacity to afford proper excitation to the generator field coils at 150 per cent of the generator rating. The terminal voltage shall be 125 volts d-c. A rheostat shall be furnished for the exciter field and shall be of the rotary type suitable for mounting on the back of the power switchboard with the controls extending through to the front of the switchboard.

TP13-7. DESIGN AND DRAWINGS. - a. The detailed design of the standby unit shall be such that all working parts shall be readily accessible for inspection and repair, easily duplicated, and readily replaced with each and every part of the equipment of the machine properly designed and suitable for the uses and service required.

b. The Contractor shall submit drawings, specifications and characteristic curves for the proposed standby unit for approval. The drawings shall include the engine, generator, exciter, and all accessories, with dimensions of concrete base for mounting. Accessories shall be listed on the drawings by catalog number with name of manufacturer; and shall be accompanied by cuts and the manufacturer's specifications for the accessories, all properly numbered to agree with the list as shown on the drawings.

TP13-8. INSTALLATION. - All work shall be neatly and accurately accomplished and shall be in accordance with the highest standards of practice for equipment of the type to be furnished. The engine and generator shall be accurately aligned on the bed-plate and securely attached thereto. Provision shall be made for lifting the engine and generator, each separately, and the entire unit completely by a crane. The unit shall be erected accurately to line and level, including the concrete base required therefor; thoroughly secured; and every detail of the work of installation shall be accomplished in a thoroughly workmanlike manner.

TP13-9. INSPECTION AND TESTS. - a. Shop tests. - The complete engine unit, including cooling system, etc., shall be run two hours continuously at a load corresponding to 50 per cent overload of generator on dynamometer test. The combined unit shall be tested by operation at the works of the manufacturer for not less than 8 hours in the presence of an authorized representative of the Contracting Officer. Under this test the set shall be run at rated speed, voltage and output and at rated speed and voltage at varying loads from no load to 125 per cent overload. Any other tests requested by the Contracting Officer during the eight hour running test shall be made at the works of the manufacturer. Under all tests there shall be no evidence of serious vibration. The valve setting and governor adjustments shall be checked with the combined unit operating under various loads in the speed range specified. Immediately after the tests, the Contracting Officer will require the engine to be opened up for inspection. A typewritten record of all shop tests, including all observations, results and graphs, shall be certified and submitted to the Contracting Officer, in triplicate, as soon as practicable after completion of the tests.

b. Final acceptance tests. - Final acceptance tests and trials of the gasoline-electric generator set shall be made by the Contractor upon completion of the installation. The tests shall cover a period of 12 continuous hours, during which period the combined engine-generator unit shall provide the normal rated output. If during the tests any imperfections of equipment, workmanship, or arrangement is found, proper correction shall be made and the entire test or any portion of it, as directed by the Contracting Officer, shall be repeated.

in order to secure approval in these tests, the gasoline engine shall operate smoothly, without undue noise or vibration; the governor shall maintain an even speed at all loads and the carburetors shall function without flooding and without back-firing; the electrical equipment shall operate without any indication of excessive heating and shall maintain an even voltage at all loads. Such additional tests as necessary may be required by the Contracting Officer. A representative of the manufacturer of the unit shall supervise the running of final acceptance tests. All final acceptance tests shall be made in the presence of an authorized representative of the Contracting Officer.

TP13-10. PAINTING. - Shop painting shall be in accordance with the provisions in Paragraph TP17-4 b. Such retouching as may appear necessary in the opinion of the Contracting Officer shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust-preventative compound. Field painting of all exterior parts, except brass, bronze or finished surfaces, shall be done in accordance with the provisions in Paragraph TP17-4 b.

TP13-11. PAYMENT. - a. Payment for furnishing and installing the gasoline electric standby unit, complete and placed in operation, will be made at the contract price for Item 18, "Gasoline-Electric Standby Unit". Payment shall include all costs of furnishing the concrete base, bolts, sleeves, nuts, washers, exhaust pipe assembly with silencer and insulation, and all costs of grouting the unit.

b. Partial payment up to 50 per cent of the contract price will be made when the equipment is delivered to the site of the work, provided the quality of such equipment is satisfactory to the Contracting Officer, but in no case will the payment to the Contractor exceed the cost of the equipment delivered to the site of the work. If any equipment stored and partially paid for is not kept protected, no further partial payments will be made.

c. Payment for all testing shall be included in the contract price for Item 18.

PART IV

SECTION XIV. TRAVELING CRANE (Item 19)

TP14-1. WORK INCLUDED. - The Contractor shall design and install one traveling crane complete. The crane shall be mounted on the crane rails in the pumping station. The crane shall be installed in accordance with the drawings and specifications complete and ready for operation.

TP14-2. GENERAL DESCRIPTION. - The crane shall be hand-operated, and shall have a working capacity of not less than 5 tons carried on one trolley. The distance from center line to center line of crane rails shall be 25 feet 7 inches. The distance from operating floor to top of crane rail shall be 12 feet. Clearance limitations are shown on the drawings.

TP14-3. DETAILED DESCRIPTION. - The crane shall consist essentially of a double-I-beam bridge mounted on two trucks, each truck having two double-flanged wheels and geared for hand-chain-operated travel, four crane stops for attachment to the crane rails, and a chain-operated traveling trolley provided with an integral, chain-operated, self-locking hoist. The crane shall be similar and equal to the "Shaw-Box", Type "BR", as manufactured by Manning, Maxwell and Moore, Inc., or to the two-speed double beam Figure 22 Catalogue No. 12-c as manufactured by the Wright Manufacturing Co., Division of the American Chain Company. The hoisting rope shall conform to the requirements of Federal Specification RR-R-571 for "Rope, Wire", Type XXXIII, shall be thoroughly impregnated with a corrosion resistant lubricant satisfactory to the Contracting Officer, and shall provide for a vertical lift of not less than 35 feet. The operating chains shall provide for hand operation and the distance from the engine-room floor to the top of the crane rail shall be 12 feet. The hoist drum shall be grooved to receive the wire rope. Provisions shall be made for proper lubrication of all moving parts. After installation the crane shall be tested for 25 per cent overload.

TP14-4. DESIGN. - a. The detailed design of the traveling crane shall be in accordance with the drawings and the specifications. All working parts shall be readily accessible for inspection and repair, properly designed and suitable for the use and service required.

b. The design stress for any member or part of the material covered by these specifications shall be not greater than one-fifth of the ultimate strength of the material used.

TP14-5. DRAWINGS. - The Contractor shall submit for approval detail drawings for the traveling crane he proposes to install, in sufficient detail to check the design. These drawings shall include a complete and itemized list of all parts, with the grade and class of material or make of a standard article, the Contractor proposes to

furnish. The item number in the list of parts shall be shown on the drawings by means of a circle enclosing the item number and a solid light line connecting the circle to the part. Thickness of plates and sizes of structural shapes must be shown either on the part or in the itemized list of parts. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details and by other means. Any item or part needed to provide a complete and workable installation in accordance with the intent of these specifications shall be supplied by the Contractor whether or not it is included in the drawings, the list of parts, or in the requirements of these specifications.

TP14-6. MATERIALS AND WORKMANSHIP. - The traveling crane shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as submitted by the Contractor and approved by the Contracting Officer and shall conform to the provisions of Section VIII, where applicable. All metal workmanship shall be of approved standard quality.

TP14-7. INSTALLATION. - The traveling crane shall be assembled and installed in the pumping station as shown on the drawings.

TP14-8. INSPECTION AND TESTS. - The traveling crane shall be tested by the Contractor under the supervision of the Contracting Officer as soon as practicable after installation. The field tests shall include complete operation throughout all functions. Acceptance will not be made until such tests are completed to the satisfaction of the Contracting Officer.

TP14-9. PAINTING. - Shop painting shall be in accordance with the provisions of Paragraph TP17-4. Such retouching as may appear necessary in the opinion of the Contracting Officer shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust preventive compound. Field painting of all exterior parts, except brass, bronze or finished surfaces shall be done in accordance with the provisions in Paragraph TP10-12 applying to gate hoists.

TP14-10. PAYMENT. - a. Payment for designing, furnishing, installing and painting the traveling crane, complete and placed in operation, will be made at the contract price for Item 19, "Traveling Crane", and shall include all necessary accessories not included in any other item.

b. Partial payments up to 50 per cent of the contract price will be made when the equipment is delivered to the site of the work provided the quality of such equipment is satisfactory to the Contracting Officer, but in no case will the payment to the Contractor exceed the cost of the equipment delivered to the site of the work. If any equipment stored and partially paid for is not kept protected, no further partial payments will be made.

PART IV

SECTION XV. MISCELLANEOUS EQUIPMENT (Items 20 to 25, incl.)

TP15-1. WATER SUPPLY AND PLUMBING FIXTURES (Item 20). - a. Work included. - The Contractor shall install the plumbing fixtures, waste, drain and vent piping and the water supply system complete as shown on the drawings and specified herein. The work designated as the water supply system shall include the engine cooling water system, the hydraulic-operated valve control system, the main water supply system, and the water supply to plumbing fixtures, heating boiler, and hose cocks. The existing 3-inch water service to the present building is of adequate size and shall not be replaced. The City of Hartford will furnish and install the water meter for the new building. The Contractor shall install all pipe, valves, cocks, and fittings necessary for a complete installation as shown on the drawings and required by these specifications. The Contractor shall submit for approval detail drawings and data descriptive of the water supply and plumbing fixtures which he proposes to install.

b. Piping and valves. - (1) Piping for the water supply system shall be standard weight wrought-iron pipe meeting the requirements of Federal Specification WW-P-441a for Wrought-Iron Pipe. Fittings shall be standard malleable iron pipe fittings. All piping and connections shall conform to local laws and regulations. Ground joint unions shall be inserted in every 30-foot run of pipe, at each piece of equipment and at such other points as required to facilitate the assembly and dismantling of the piping. The piping shall be supported at least every ten feet on Clevis or equal hangers capable of screw adjustment after erection of the pipe. Minimum vertical adjustment shall be 1-1/2 inches. Hanger rods shall be fastened to the concrete by means of concrete inserts. For pipes 3/4 inch to 2 inches, inclusive, hanger rods shall be 3/8 inch diameter; for 2-1/2 inches to 3-1/2 inches, inclusive, rods shall be 1/2 inch diameter.

(2) Valves shall be standard brass gate valves similar and equal to Crane No. 438 or Walworth No. 4. Funnels on the cooling water waste from the engines shall be 9 inches in diameter and 9 inches high, made of 16-ounce copper, and shall have a beaded top. The water supply connection to each engine shall be made with a short section of brass or bronze flexible metal hose similar and equal to that manufactured by the Chicago Metal Hose Corporation of the Packless Metal Products Corporation. Hose cocks shall be 3/4-inch finished brass tee-handle faucets similar and equal to Crane No. C31103. Four-way valves for the hydraulic operated valve control system shall be similar and equal to the Walworth Class 150 Steeliron Lubricated Plug Valve No. 1734 screw type. The four-way valves shall be provided with a specially designed operating wrench with pointer to indicate the position of the plug. A carefully designed cast or enameled plate with the words "open" and "close" shall be provided for use in conjunction with the pointer end of the wrench.

c. Drains. - (1) The work shall include the waste lines from the plumbing fixtures, the exhaust pipe draw-off, roof drains, waste cooling water and other drain and waste piping shown on the drawings.

(2) Piping. - Drain, waste, and vent piping shall, in general, be standard weight galvanized wrought-iron pipe conforming to Federal Specification WW-P-441a for Wrought-Iron Pipe. Fittings shall be standard screw type galvanized cast iron drainage fittings. Cast-iron soil pipe shall be bell-and-spigot conforming to Federal Specification WW-P-401 for Cast Iron Soil Pipe and Fittings. Cast-iron pipe shall be laid with the bell end pointing in the opposite direction to the flow of the waste water. The joints shall be made tight with pure oakum caulked into the bell of the pipe until one-third full, and the remaining two-thirds of the bell shall be poured full of molten pig lead and caulked flush with the hub. Vent lines extending through the roof shall be flashed with 16-ounce copper brought up and turned down into the pipe. Vents shall extend at least 18 inches above the roof. Roof drains shall be cast-iron soil pipe with dome and strainer.

d. Plumbing fixtures. - The plumbing fixtures shall conform to the requirements of Federal Specification WW-P-541a for Plumbing Fixtures. The lavatory shall meet the requirements for Outfit No. IB21, cast-iron enameled, 21-inch wall-hung. It shall be furnished complete with one compression faucet, 1-1/2-inch P trap, chain-stay, chain, and stopper. The water closet shall meet the requirements for Outfit No. E46F vitreous china water closet, siphon jet elongated bowl, with flushing valve. All exposed supply and drain piping at the fixtures shall be chromium-plated brass tubing and all handles and escutcheons shall be chromium-plated brass.

e. Emergency water pump and tank. - (1) General. - The Contractor shall install complete an emergency water supply system for the purpose of supplying water under a pressure of approximately 75 pounds per square inch to the hydraulic-operated-valve control system in the event of failure of the city water supply system. The emergency water supply system shall consist of an electric motor driven pump, a 250-gallon vertical water storage tank, and all necessary valves and piping as shown on the drawings and required by these specifications. The Contractor shall submit for approval detail drawings and data descriptive of the motor control pump, tank, valves, and piping which he proposes to install.

(2) The emergency water pump shall be of the horizontal split-case, single suction, two stage, bronze-fitted, centrifugal type. The casing shall be of close-grained, cast iron so designed that access may be had to the interior of the pump for inspection purposes. The pump shall have bronze impellers of the enclosed type, hydraulically balanced, and firmly secured to the shaft. The shaft shall be of stainless steel accurately ground to size and polished to a smooth surface. The shaft shall be supported by two double row ball bearings located on each side of the pump. Bearings shall be grease-lubricated. Suitable

stuffing boxes shall be provided to prevent air leakage. The pump shall have a capacity of 60 G.P.M. against a total head of 170 feet. The pump shall be direct-connected through a flexible coupling to a 220-volt, 3-phase, 60-cycle, 1750 r.p.m. squirrel cage induction motor, having a limiting temperature rise of 40 degrees C. The motor shall have low starting current and normal starting torque characteristics. The horsepower rating of the motor shall be not less than the power required by the pump at specified capacity and head and the motor shall be manufactured and rated in accordance with the N.E.M.A. Standards. The pump and motor shall be mounted on a common cast iron or structural steel base. The Contractor shall install in this pump a separately mounted combination manual and magnetic "cross-the-line" type watertight starter with thermal overload protection and reset button in the cover. The control shall be similar and equal to General Electric Company's Type CR-7008-C1K, Size 1, NEMA Type 4, complete with relay heaters.

(3) The emergency water supply storage tank shall be of welded steel construction. It shall be of the vertical cylindrical type as shown on the drawings. Connections to the tank shall be made in an approved fashion subject to the approval of the Contracting Officer.

f. Pressure reducing valves. - (1) A pressure reducing valve shall be installed in the engine cooling water system and shall be so arranged and adjusted that cooling water will be delivered to the engines at a pressure not greater than 15 pounds per square inch.

(2) A pressure reducing valve shall be installed in the water supply to the pumping station and shall be so arranged and adjusted that water in the pumping station with the exception of the water supply for the operation of the hydraulic valves will be approximately 45 pounds per square inch. The water supply for the operation of the hydraulic valves shall be at full city pressure.

(3) Pressure reducing valves shall operate satisfactorily under a variable initial pressure of from 75 to 150 pounds and shall maintain a constant delivery pressure as specified above. All metal parts of the valves shall be of bronze except the steel springs and cap screws which shall be specially treated to prevent rusting. The valves shall have renewable composition seats.

g. Payment. - Payment for furnishing and installing the water supply system, plumbing fixtures, drains, emergency water pump motor, control and tank, valves, and piping will be made at the contract price for Item 20 "Water Supply and Plumbing Fixtures".

TP15-2. CARBON DIOXIDE FIRE EXTINGUISHING EQUIPMENT (Item 21). - a. Work included. - The Contractor shall install a complete manually operated carbon dioxide fire extinguishing system for the protection of the three gasoline engines driving the pumps and the gasoline-electric generating unit. The system shall be installed as indicated on the drawings and shall consist essentially of the following equipment:

4 - 50-pound capacity cylinders of carbon dioxide
1 - Steel angle frame assembly with wire mesh enclosure
5 - 1/2-inch manually operated directional valves with cast bronze name plates
2 - Manually operated remote control stations
1 - 3/4-inch feed to header and 3/4-inch pipe header
1 - Set 1/2-inch branch piping to each engine
1 - Spare parts kit and operating instructions

In addition to the above, there shall be furnished two portable, 15-pound, carbon dioxide extinguishers, each with 3 feet of hose, and a permanent shut-off of the seat type. Each portable extinguisher shall be mounted on a wall bracket. The equipment shall be similar and equal to that manufactured by Walter Kidde and Company or the C-O-Two Equipment Company. The Contractor shall submit for approval detailed drawings and data descriptive of the carbon dioxide fire extinguishing equipment he proposes to install. The Contractor shall also provide two test cylinders for testing the system.

b. Cylinder battery. - (1) The cylinder battery shall consist of a bank of four 50-pound capacity carbon dioxide cylinders assembled in a framework and arranged so they can be weighed without removing them from the framework and without putting the system out of service. The cylinders shall stand in their normal upright position and shall be properly guarded with removable wire mesh screening.

(2) Each cylinder shall be equipped with a cylinder valve having a 1 inch I.P.S. American Standard tapered thread screwing into the cylinder. A Syphon tube having a clear hole diameter of 7/16 inch plus or minus 1/64 inch shall extend from valve approximately to the base of the cylinder so that liquid carbon dioxide is taken from the cylinder. The cylinder valve shall be made of forged brass of sufficient strength to withstand a test pressure of 3,000 pounds per square inch without distortion. Each valve shall be equipped with a safety disc made of rolled gold on a copper metal base, for the purpose of releasing the gas in the cylinder at excessive temperatures.

(3) To each cylinder valve shall be attached a cutter valve housing a hollow tubular cutter, the advance of which serves to cut a clean hole through the safety disc to permit the carbon dioxide to discharge. Advance of the cutter shall be caused by the rotation of a lever approximately 6-1/2 inches long. The maximum force necessary to effect rotation of this lever shall be 15 pounds per cylinder.

(4) The outlet of each cutter valve shall be connected by means of a flexible metal loop to a common manifold. The connecting tee at the manifold shall have as an integral part a check valve to prevent loss of gas in the event that one or more cylinders are disconnected from the manifold at a time when gas is discharged. The arrangement must be such that premature discharge of the gas in one cylinder will not cause the discharge of gas in the other cylinder.

c. Piping system. - (1) A suitable piping system shall be provided to convey the carbon dioxide from the cylinder battery to the space protected. The gas shall be discharged through suitable shielded type outlets, specially designed to discharge the gas in such a manner as to eliminate turbulence, prevent the entrainment of air, and produce the maximum amount of carbon dioxide "snow" without possibility of freeze-up. All pipe and fittings leading from the directional valves to the engines shall be hot-dipped, galvanized and scale-free. All tees, elbows, crosses, and other fittings must be galvanized and have a minimum bursting pressure of 6,000 pounds per square inch. Distribution piping and its support at each engine shall be extra heavy polished brass pipe. All fittings shall be extra heavy cast bronze fittings having a bursting pressure not less than 6,000 pounds per square inch.

(2) The system shall be so arranged that two carbon dioxide cylinders are connected and ready for use at all times and the other two are connected for reserve use in the event the contents of the first two cylinders are exhausted. Two break glass pull boxes shall be provided and mounted as shown on the drawings, each pull box controlling two cylinders. Each pull box shall consist of a pull handle which is connected through suitable corrosion-resisting cable to the releasing device at the cylinders. The cable is to be run in 3/8 inch I.P.S. conduit and enclosed corner pulleys shall be employed at all right-angle bends. The entire system shall be installed in accordance with the recommendation of the manufacturer.

d. Payment. - Payment for furnishing and installing the carbon dioxide fire extinguishing equipment will be made at the contract price for Item 21, "Carbon Dioxide Fire Extinguishing Equipment".

TP15-3. SUMP PUMP (Item 22). - a. Work included. - The Contractor shall install one vertical centrifugal sump pump of the submerged type with discharge piping, as indicated on the drawings. The Contractor shall submit for approval detailed drawings and complete data descriptive of the sump pump, float switch and piping, which he proposes to install.

b. Description. - (1) Pump. - The pump shall have a capacity of 40 gallons per minute against a total head of 40 feet. The pump shall have a cast-iron casing and a bronze impeller of either the closed or open type capable of passing coarse or fibrous material. The shaft shall be of stainless steel enclosed in a wrought-iron support pipe. The upper bearing shall be of the combined radial and thrust type, grease-lubricated anti-friction bearing. The lower and intermediate bearing shall be made up of a non-seizing, non-scoring high lead bronze bearing bushing with a grease reservoir. The reservoir shall be connected through suitable piping to an Alemite or Zerk fitting over the pit cover. The pump shall be bolted or welded to a small cover plate which in turn shall be bolted to the sump pit cover.

(2) Motor. - The pump shall be driven by a 220-volt, single-phase, 60-cycle, 1750 r.p.m. vertical, squirrel-cage, drip-proof, induction motor with low starting current and normal starting torque characteristics. The motor shall be rated not less than one horsepower with a limiting temperature rise of 40 degrees Centigrade, and shall have a special moisture resisting treatment for all insulation in accordance with the N.E.M.A. Standards.

c. Payment. - Payment for furnishing and installing the sump pump complete will be made at the contract price for Item 22 "Sump Pump".

TP15-4. GASOLINE TANK AND PIPING (Item 23). - a. Work included. - The Contractor shall install one 3000 gallon gasoline storage tank together with fill and vent pipes, gasoline gage, and supply and drain piping to the gasoline engines and gasoline-electric standby unit as shown on the drawings. The Contractor shall submit for approval detailed drawings and data descriptive of the gasoline tank, piping and gage which he proposes to install.

b. Tank. - The gasoline tank shall be of welded steel construction, and shall comply with the legal requirements of the City of Hartford, Connecticut.

c. Piping. - All piping outside the pumping station shall be wrought-iron pipe conforming to Federal Specification WW-P-441a. Fittings shall be malleable iron screw type fittings conforming to Federal Specification WW-P-521b. All gasoline piping inside the pumping station shall be soft copper tubing conforming to Federal Specification WW-T-799, Type K, installed with flared fittings. The foot valves on the suction lines inside the gasoline tank shall be of the Single Poppet type similar and equal to Amco Figure 438. The vent pipes shall be securely clamped to the building wall. All piping through beams shall be set in sleeves. All piping through outside walls and floor slab shall be set in sleeves and poured with lead. All pipe runs shall be perpendicular or parallel to building walls. Piping shall be supported on hangers or clips spaced at eight-foot intervals and shall have a continuous pitch toward tank. Lock type caps shall be installed.

d. Gage. - The gasoline gage shall be installed on the wall of the engine room as shown on the drawings. It shall be capable of indicating the amount of gasoline in the storage tank and shall be of the automatic remote-reading type similar and equal to that manufactured by the Liquidometer Corporation of Long Island City, New York. It shall be float-operated, the motion of the float operating against bellows of a closed hydraulic system. The system shall be filled with a liquid for the purpose of transmitting the motion of the float to the indicator bellows. The indicator shall be installed in a protecting case not less than 12 inches by 12 inches and provided with a scale graduated from zero to 3000 gallons. The flexible hydraulic tubing shall be protected by a metallic armor for connecting the indicator with the float mechanism. The connection between the gasoline tank and gage line shall be protected by a heavy structural steel box of suitable size.

e. Payment. - Payment for furnishing and installing the gasoline tank, gage, and piping will be made at the contract price for Item 23 "Gasoline Tank and Piping".

TP15-5. DIESEL FUEL TANK AND PIPING (Item 24). - a. Work included. - The Contractor shall install one 1000-gallon diesel fuel tank together with fill and vent pipes, fuel gage, lock type fill boxes on gage well and fill pipe and piping as shown on the drawings. The existing concrete cradle now used to support the gasoline tank shall be checked, repaired and brought to grade. The Contractor shall submit for approval detailed drawings and data descriptive of the fuel gage he proposes to install.

b. Tank. - The diesel fuel tank shall be of welded steel construction and shall comply with the legal requirements of the City of Hartford, Connecticut. All piping outside the pumping station shall be wrought iron pipe conforming to Federal Specification WW-P-441a. Fittings shall be malleable iron screw type conforming to Federal Specification WW-P-441a. Fittings shall be malleable iron screw type conforming to Federal Specification WW-P-521b. All fuel oil piping inside the pumping station shall be copper tubing conforming to Federal Specification WW-P-799, Type K, soft annealed installed with flared fittings.

c. Gage. - The Contractor shall install a fuel gage on the wall of the engine room as shown on the drawings. The gage shall be of the automatic remote reading type similar and equal to that manufactured by the Liquidometer Corporation of Long Island City, New York. The gage shall be of the same type and manufacture as the gasoline gage specified above. The indicator shall be installed in a protecting case not less than 12 inches by 12 inches and provided with a scale graduated in gallons to 1000 gallons. The gage tubing from tank to indicator shall be protected by metallic armor and shall be installed in two-inch electrical conduit. The connection at the tank shall be protected by a heavy structural steel box of suitable size. Crouse-Hinds Company condulets LB 67 or equal shall be used where the fuel gage line enters the building.

d. Payment. - Payment for furnishing and installing the diesel fuel tank and piping will be made at the contract price for Item 24 "Diesel Fuel Tank and Piping".

TP15-6. FLOAT GAGE (RECORDING) (Item 25). - a. Work included. - The Contractor shall install a float gage of the recording type. The Contractor shall submit for approval detailed drawings and data descriptive of the gage and accessories which he proposes to install.

b. Description. - The float gage shall be similar or equal to Model FC-2 as manufactured by Julien P. Friez & Sons, Inc., Baltimore, Maryland. The recorder shall be designed for recording data for daily periods. The float, tape, and counterweight shall be made of corrosion-resisting metal. The device shall be mounted on a suitable table or bench provided with a baked enamel wire protection grille for float and

counterweight tapes and clock weight. The float well and counterweight well shall be of standard weight, genuine wrought iron pipe.

c. Payment. - Payment for furnishing and installing the water level recorder, float well, and counterweight well will be made at the contract price for Item 25 "Float Gage (Recording)".

PART IV

SECTION XVI. INSTALLATION AND TESTING OF EQUIPMENT

TP16-1. WORK INCLUDED. - a. The Contractor shall install under other applicable items of the contract all of the equipment furnished by him under the contract, and, under Item 26, shall install the following equipment to be furnished by the Government:

(1) Three 36-inch volute pumps.

(2) One 16-inch volute pump.

(3) Three gasoline engines with silencers and exhaust piping.

(4) One diesel engine with silencer and exhaust piping.

(5) Four right angle gear units for the pumps.

(6) Intake and discharge piping and valves for all pumps.

b. The work of the installation of equipment to be furnished by the Government will be inspected during installation by the Contracting Officer, and the Contractor shall furnish competent supervisors to direct the installation of this equipment. The Government will provide the services of a representative of the equipment manufacturer to inspect and check the installation of equipment at such times as the Contracting Officer deems such services are required.

TP16-2. DELIVERY. - The equipment to be furnished by the Government will be available within 450 calendar days after the date of receipt by him of notice to proceed, and the Contractor will be given 10 days notice before arrival of the equipment furnished by the Government.

TP16-3. PACKING AND SHIPPING. - All of the equipment that is to be furnished by the Contractor and installed under the contract shall be adequately protected during shipment and shall be brought to the site of the work in good condition, free from damage, corrosion, or other defects. The apparatus shall be boxed, crated, or otherwise protected so as to prevent damage during shipment. Before shipment, all the apparatus shall be thoroughly cleaned, unfinished iron and steel surfaces shall be painted as required in Section XVII and all finished surfaces that might be subject to rust or corrosion prior to assembly shall be coated with a suitable, easily removable, rust-preventing compound.

TP16-4. INSTALLATION. - The Contractor shall install, erect, attach or build into the structures all the machinery, piping, and other metal work in a workmanlike manner as shown on the drawings or directed by the Contracting Officer. Wherever possible, all parts shall be made accurately to standard gauge to facilitate replacement and repair. All work of the installation of the equipment shall follow

the best modern practice in the installation of machinery of this type. All work of installation shall be done by mechanics skilled in their various trades. Within 60 days after the date of receipt by the Contractor of notice to proceed, the Contracting Officer will furnish the Contractor detailed drawings of the concrete bases showing the size and location of all anchor bolts and sleeves that will be required for the equipment. The equipment shall be anchored to concrete foundations by means of steel anchor bolts. The anchor bolts shall be set at the time of placing the concrete foundations. The concrete foundations for the equipment shall be constructed to the dimensions shown on these drawings and shall be securely attached to the structural concrete floor slab by means of steel dowels. The equipment shall be given a touch-up coat of paint as required before finish paint is applied (see Section XVII).

TP16-5. PUMPS, GEAR UNITS, DISCHARGE PIPING, VALVES AND ACCESSORIES. - a. Three 36-inch volute pumps and one 16-inch volute pump complete, discharge piping, valves, gear units, anchor bolts and accessories shall be installed in the pumping station at the locations as shown on the drawings. The complete pumping units shall be set accurately plumb and anchored to the concrete floor slab by means of anchor bolts. The Contractor will be required to grout in the wall section of each pump after the pump is completely assembled. The anchor bolts shall be set at the time the concrete is placed. The gate valves and horizontal piping shall be supported by concrete pedestals as shown on the drawings.

b. The Contractor shall construct box forms in the concrete walls for the installation of intake and discharge wall castings. (See Paragraph TP6-17 c). Embedding of wall castings in concrete during the placing of the concrete for walls will not be permitted. The pumps, valves, flexible connections, intake and discharge piping shall be assembled with all bolts on the piping installed and tightened. The Contractor shall provide steel wedges and shims for the purpose of leveling the pumps. The wedges shall be approximately 6 inches long, 2-1/2 inches wide and 1/2 inch thick, tapered to a feather edge. The pumps shall be set so that, when checked by placing a machinists' level on the half-coupling on the pump stub-shaft and rotating the pump shaft, there will be no movement of the bubble in the level as the shaft is rotated.

c. After the pumps are properly set, but before the pumps and wall castings are grouted in place, the gear units, vertical shafts and engines shall be set in position on their anchor bolts and checked for proper alignment, to the satisfaction of the Contracting Officer. The section of shaft on top of the pumps shall then be removed and the pump settings rechecked. When the pumps are properly set and all piping and flexible connection bolts tightened, the pump bases and wall castings shall be grouted. After the grout has set sufficiently, the wedges shall be removed and holes left by the wedges shall be filled with grout. The grout for the pump bases shall be of non-shrinking cement, similar and equal to "Embeco" cement as manufactured by the Master Builders of Cleveland, Ohio. The grout shall be well worked beneath all parts of

the base. When the grout has attained its initial set, it shall be rubbed to a smooth finish. The three 36-inch bell-and-spigot joints shall be made tight with pure oakum caulked into the bell until one-third full. The remaining two-thirds of the bell shall be poured full of lead alloy and caulked flush with the hub. The lead alloy shall consist of 96 per cent lead, 2 per cent tin and 2 per cent antimony.

d. The Contractor shall assemble the gear units and vertical shafting on each pump. Flexible and rigid couplings shall be thoroughly cleaned with suitable cleaning solvents before they are assembled. The bolts on the couplings shall be carefully and evenly tightened. The gear units shall then be properly aligned by the use of shims and wedges as specified in subparagraph b above. Maximum misalignment of the flexible couplings unit shall not exceed .005 inch in either an angular or parallel direction, as checked by a dial indicator. After the units have been properly aligned, the gear units shall be grouted as specified in subparagraph c above. The steady bearing plates shall then be doweled to the steady beam with No. 6 tapered dowels.

TP16-6. ENGINES. - Three gasoline engines and the diesel engine with silencers and exhaust piping, anchor bolts and accessories shall be installed in the pumping station at the locations shown on the drawings. The Contractor shall furnish and install two one-inch thicknesses of insulation similar and equal to Keasbey & Mattison "Hy-Temp", Johns Manville "Superex" or Carey "Hi Temp" with an 8-ounce canvas jacket for exhaust pipe assembly insulation as shown on the drawings. Insulation shall be preformed in semi-circular 180-degree sections. Block insulation on piping will not be acceptable. All joints shall be staggered and sealed with high temperature cement plastic. The canvas jacket shall be cut-back 2 inches from all exposed metal surfaces. Where canvas jacket is cut-back the insulation shall be covered with asbestos paper extending under the canvas and to the exposed metal surfaces.

TP16-7. PIPE FITTING. - a. - All pipe connections and joints shall be made tight and shall conform to local laws and regulations. Pipe threads shall be coated with Crane thread lubricant or equal so as to insure a tight joint. Sleeves for all pipes through floors and walls shall be extra strong, black wrought-iron pipe conforming to Federal Specification WW-P-441a for Wrought Iron Pipe. A lead joint shall be caulked between the pipe and the sleeve to form a watertight joint as shown on the drawings or as directed. Before any piping is covered up it shall be tested for leaks and made tight. The steam and water piping shall be tested by filling the systems with water and holding them for two hours under a pressure of 40 pounds per square inch for the steam piping and 150 pounds per square inch for the water piping. All piping tests shall be conducted as directed by the Contracting Officer and in the presence of his authorized representative.

b. In all runs of screw type piping, ground joint unions shall be inserted in every 30-foot run of pipe, at each item of equipment, and at such other places as is required to facilitate assembling and disassembling the piping.

TP16-8. OPERATION OF EQUIPMENT. - a. Equipment furnished by the Contractor. - (1) After installation, all of the equipment and apparatus furnished and installed under the contract shall be placed in operation by the Contractor and operated for a sufficient length of time and in such a manner as to satisfy the Contracting Officer that the equipment has been properly installed and that it meets all of the other requirements of the specifications. The Contractor shall also perform such field tests as are required by the specifications and as may be directed by the Contracting Officer, relating to the following equipment: Sluice gates, complete with hoists (see Paragraph TP10-11). Heating and ventilating equipment (see Paragraph TP11-18). Electric light and power system (see Section XII). Gasoline-electric standby unit (see Paragraph TP13-9). Traveling crane (see Paragraph TP14-8). Miscellaneous equipment (see Section XV).

(2) In the event the operation or testing of the equipment by the Contractor discloses any defects or failure to comply with the specifications, the equipment shall be immediately shut down and said defect or failure shall be corrected by the Contractor to the satisfaction of the Contracting Officer, and the equipment shall again be placed in operation (see Paragraphs TP16-10 b and TP16-11 a).

b. Equipment furnished by the Government. - After installation, all of the equipment furnished by the Government (see Paragraph TP16-1 a), and installed under the contract shall be placed in operation by the Contractor and operated for a sufficient length of time and in such a manner as to satisfy the Contracting Officer that the equipment has been properly installed. In the event the operation of the equipment by the Contractor discloses any defect due to faulty or improper installation, the equipment shall be immediately shut down and said defect shall be corrected by the Contractor to the satisfaction of the Contracting Officer. All field test of this equipment will be conducted by the Government (see Paragraphs TP16-10 and TP16-11 b).

TP16-9. FUEL AND LUBRICANTS. - All electric energy necessary to place the equipment furnished under these specifications in operation and to perform the required field tests shall be furnished by the Contractor. The Government will furnish all fuels and lubricants necessary to place in operation and test all equipment furnished under the contract and that furnished by the Government. All oil reservoirs and grease containers shall be filled to their proper operating level.

TP16-10. TESTS. - a. Installation. - Special care shall be exercised when aligning gear unit, gasoline and diesel engines, and pump shafts to insure free running in the bearings without binding. The shafts shall be turned by hand for at least 50 complete revolutions of the pump impeller. After the pump unit is completely installed it shall be given a thorough check for alignment and anchorage. The gate valves shall be opened and closed to insure free travel from the fully closed to the fully open positions. The check valve shall be swung open and shut without causing any undue binding.

b. Final operations. - After complete installation of

pumping station equipment, the Contractor shall operate the equipment for sufficient duration to ascertain that all equipment is in good running condition. Any changes or adjustments necessary to secure satisfactory operation shall be made by and at the expense of the Contractor. Provided that if any part of the equipment is found to be defective due to no fault of the Contractoras determined by the Contracting Officer, the Contracting Officer may order the Contractor to correct such defects and payments therefor will be made to the Contractor under the provisions of Article 3 of the contract.

TP16-11. PAYMENT. - a. Equipment furnished by the Contractor. - Payment for installing and testing the equipment and apparatus furnished by the Contractor shall be included in the applicable contract prices. (See Sections IX to XV incl.)

b. Equipment furnished by the Government. - Payment for installing the equipment furnished by the Government (see Paragraph TP16-1 a) will be made at the contract price for Item 26 "Installing Equipment Furnished by the Government", and shall include the cost of cleaning, placing, painting, testing and maintaining said equipment until final acceptance of the work by the Contracting Officer. This item shall also include all costs for furnishing and installing the engine exhaust pipe insulation as specified and all costs for furnishing jute and lead alloy for bell-and-spigot joints, the concrete bases for the engines, gear units, pumps, valves, and piping.

c. All anchor bolts, sleeves, and washers for equipment furnished by the Government will be paid for at the contract unit price for Item 13 "Miscellaneous Pipe and Fittings". (See Paragraph TP8-5a(2).)

PART IV

SECTION XVII. PAINTING

TP17-1. WORK INCLUDED. - The Contractor shall perform all shop and field painting of equipment, and all other painting required at the pumping station, except that shop painting of equipment furnished by the Government will be done by others. All exposed iron and steel work not galvanized, all unfinished iron or steel parts of the equipment, all doors, doorframes, and louvers, and the finished concrete surfaces of the engine-room floor and side walls shall be painted.

TP17-2. PAINT MATERIALS. - a. All paint and paint materials shall conform, where applicable, to Federal Specifications of Group TT.

b. Priming coats for metal work shall be pure red lead paint, except that priming coats for standard manufactured articles and equipment may conform to the manufacturer's standard practice when approved by the Contracting Officer. Red lead paint shall be mixed in approximately the following proportions.

Paste red lead	100 pounds
Raw linseed oil	1-7/8 gallons
Turpentine	2-1/2 pints (max.)
Drier	2-1/2 pints (max.)

c. Except as otherwise provided, finish painting above the engine-room floor shall be done with pure lead and oil paint of a composition and color as specified herein or approved by the Contracting Officer. With the exception of color pigments, the only pigments used in the paint shall be lead carbonate, zinc oxide, and titanium dioxide. No lithopone or fillers shall be used in the paint. Samples of all paint shall be submitted to the Contracting Officer for approval and selection.

TP17-3. PAINTING STEEL. - a. All ungalvanized structural and miscellaneous steel work not to be encased in concrete shall be given one shop coat and one field coat of read lead paint. After the shop fabrication has been completed and accepted, all material shall be cleaned of rust, loose scale, dirt, oil, grease, and other foreign substances, by wiping with gasoline or benzene, or by other approved means. After cleaning, the steel shall be given one shop coat of red lead paint. Surfaces which will not be accessible after assembly, but not in contact in riveted connections, shall be given a second shop coat.

b. After erection, the steel shall be touched up by painting over all spots where the shop coat has been scratched, knocked off, or otherwise damaged. After touching up, the steel shall then be given a field coat of red lead paint. Either the shop coat or field coat shall contain a small amount of lamp black so that the field coat may be

readily differentiated from the shop coat.

c. Steel above the engine-room floor shall be given two finish coats of approved gray paint (see Paragraph TP17-2 c). Finish painting of steel below the engine-room floor shall be two coats of "Kem Lustral, Dado Gray No. 205", except that walkways in pump room shall receive one coat of an approved black enamel.

TP17-4. PAINTING EQUIPMENT. - a. The equipment furnished by the Government will be painted by the equipment manufacturer. After installation, the Contractor shall touch up all painted surfaces of equipment as found necessary by the Contracting Officer with the same type and color of paint as originally used by the manufacturer. All equipment above and below the engine-room floor shall be given one field coat of paint similar and equal to "Kem-Lustral, Dado Gray No. 205", as manufactured by the Sherwin-Williams Co.

b. All unfinished iron and steel parts of the equipment furnished by the Contractor shall be given one shop priming coat, one field touch-up priming coat, and two finish coats of paint similar and equal to "Kem-Lustral, Dado Gray No. 205", as manufactured by the Sherwin-Williams Co. The sluice gates and hoists shall be painted in accordance with the requirements of Paragraph TP10-12.

TP17-5. PAINTING PIPE. - All exposed pipe, valves, and fittings shall be given one shop priming coat and two finish coats of approved paint except that brass pipe will not be painted, but shall be polished. Cast-iron soil and waste piping shall be finished with black asphalt paint. Unless otherwise directed by the Contracting Officer, pipe insulation shall be sized and painted with two coats of an approved lead and oil paint. Piping in general shall have a finish coat of "Dado Gray No. 205", and shall have arrows, indicating the direction of flow, clearly stenciled on the pipe at intervals and adjacent to valves and fittings in accordance with the color code described below. There shall be two types of arrows: (1) plain (⟶) and (2) dotted (•⟶). The Contractor shall install in the engine room a color chart, in a glazed frame, showing the color code as follows:

Use of pipe	Color of arrow	Type of arrow
Cold water (domestic)	blue	plain
Hot water	red	dotted
Engine cooling water	yellow	dotted
Engine cooling water drains	white	plain
CO_2 lines	red	plain
Gasoline supply lines	orange	plain
Gasoline return lines	green	plain
Diesel fuel line	blue	dotted
Oil burner fuel line	yellow	plain
Hydraulic valve water lines	green	dotted
Hydraulic valve waste lines	orange	dotted

TP17-6. PAINTING TANKS AND BAR SCREENS. - a. For painting of mechanically cleaned bar screens see Paragraph TP9-15.

b. The gasoline and oil tanks shall be painted in the shop with one coat of red lead paint and two coats of black graphite paint as specified in Paragraph TP10-12 for sluice gates. After installation any spots on the tanks where the paint has been damaged shall be touched up with graphite paint.

TP17-7. PAINTING CONCRETE AND BRICK. - The concrete floor of the engine-room, the concrete machinery bases, and the brick walls up to a height of 5'-6" above finish floor shall be painted with two coats of paint similar and equal to the Remuc Enamel Products as manufactured by Inortol Co., Inc., New York, N. Y. Before painting, the concrete and the brick walls shall be thoroughly cleaned of all dirt, oil, grease, and other foreign materials by scrubbing and flushing with clean, warm water. After washing, the concrete and the brick walls shall be treated with a weak solution of muriatic acid and again flushed with clean water. The concrete and the brick walls shall then be allowed to become thoroughly dry before painting. No paint shall be applied to concrete or brick walls for at least 30 days after the concrete and brick are placed.

TP17-8. APPLICATION OF PAINT. - Paint may be applied by either brushing or spraying, provided satisfactory results are obtained. No paint shall be applied on damp or frosted surfaces and material painted under cover in damp or cold weather shall remain under cover until dry. Painting shall be done in a neat and workmanlike manner and all joints and crevices shall be thoroughly coated.

TP17-9. PAYMENT. - No separate payment will be made to the Contractor for painting. Payment for paint and painting shall be included in the contract prices for the various items to which the work pertains.

PART IV

SECTION XVIII. MISCELLANEOUS (Items 27 to 32 Incl.)

TP18-1. TOPSOIL (Item 27). - a. Work included. - The Contractor shall place topsoil in the locations and to the compacted thickness shown on the drawings or as required by the Contracting Officer.

b. Materials. - (1) Topsoil shall consist of fertile, friable, natural topsoil typical of that in the locality of the project as approved by the Contracting Officer. It shall be reasonably free from sub-soil, stumps, roots, hard lumps, stones greater than 1 inch in diameter, noxious weeds, sticks or other litter. It shall contain from 4 to 12 per cent organic matter by weight, determined as loss on ignition of oven-dried samples. Prior to stripping, the topsoil shall have demonstrated its suitability by the occurrence upon it of healthy crops, grass or other vegetative growth.

(2) Topsoil shall be obtained from approved stored materials salvaged from stripping and required excavations or shall be furnished by the Contractor from other approved sources off the site. The Contractor shall submit for approval proposed outside sources at least two weeks in advance of contemplated use and shall assist in obtaining samples. If after testing of the samples this topsoil is found unsatisfactory for the seed and fertilizer applications specified, the material will be rejected unless the Contractor agrees to apply additional fertilizer of the type and amount needed to make the proposed topsoil suitable at no additional cost to the Government

c. Placing topsoil. - After the general excavation, fill and grading have been completed to the required height and dimensions, the Contractor shall apply the stored topsoil or additional acceptable topsoil if necessary, from a source approved by the Contracting Officer, to the specified depth when compacted, over the required areas to the limits shown on the drawings or as directed. Placing topsoil shall be done only when it may be permissibly followed soon after by fertilizing and seeding. On areas which are intended to receive topsoil, the compacted subgrade shall be scarified to a depth of 2 inches for the bonding of topsoil with subsoil. Topsoil is then to be evenly spread, compacted and graded to the thickness and to the elevations and slopes shown on the drawings, or as directed by the Contracting Officer. The topsoil shall be lightly rolled or tamped, and any unevenness of surface shall be corrected to conform to finished grades.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of topsoil actually placed in accordance with directions, whether obtained from stockpiles or from other sources at the expense of the Contractor. Quantities will be measured in place after compacting. Payment for topsoil, regardless of where obtained, will be made at the contract unit price for Item 27 "Topsoil".

TP18-2. FERTILIZING AND SEEDING (Item 28). - a. Work included. - The Contractor shall fertilize and seed the areas topsoiled or otherwise designated for seeding as shown on the drawings or as required by the Contracting Officer.

b. Materials and application rates. - (1) Fertilizer shall be complete commercial fertilizer, 6-10-14, applied at the rate of 1000 pounds per acre.

(2) Seed mixture shall be as follows, applied at the rate of 200 pounds per acre:

Pure Live Seed	Minimum Percentage of Mixture by Weight
Kentucky blue grass	30
Chewing's Fescue	25
Red Top	12
Rhode Island Bent	8
Perennial rye grass	5
	80
Other Materials (maximum)	20
	100

The other materials (20 per cent) shall be a mixture consisting of nonviable seed, chaff, hulls, live crop seed other than those specified above, inert matter, and weed seed not exceeding one per cent by weight of the mixture.

(3) Seed mixture shall contain seeds of the previous year's crop and shall be packed in bags labelled with the weight of seed contained, and shall be tagged to show the mixture, germination, purity, weed content and inert matter in accordance with applicable State and Federal seed laws. For the fertilizer, certificates shall be furnished indicating the guaranteed percentages of nitrogen available, phosphoric acid, water-soluble potash, the percentage of the total nitrogen derived from organic materials and the net weight and time of shipment. At least 5 weeks and not over 16 weeks prior to the start of seeding the Contractor shall furnish labor and facilities for the taking of test samples from the seed and fertilizer delivered to the site, which will be taken by representatives of the Contracting Officer and boxed for shipment to the Soils Laboratory, New England Division, Corps of Engineers, War Department, Watertown Arsenal, Building 39, Watertown, Mass. Samples from any other source will not be considered.

c. Fertilizing. - Fertilizer shall be applied uniformly over the area and well worked into the top 2 inches of the soil with a combination planker and wire mesh drag or similar device.

d. Seeding. - (1) Time of seeding. - All seed shall be sown when directed by the Contracting Officer so as to secure the greatest

possible protection against erosion. Unless specifically directed otherwise or further limited by the Contracting Officer, seed shall be sown only in the periods April 1 to June 15 and August 20 to October 1.

(2) Preparation of seed bed. - Immediately before sowing seed the Contractor shall harrow the soil to a depth of 3/4 inch by using iron rakes or spike-toothed harrows, and the finished surface grade shall be maintained in a true and even condition during the sowing operations. If seed is drilled in, harrowing will not be required. All sticks, stones, hard lumps, large roots, weeds, trash and other litter appearing at the surface shall be removed. All harrowing in of fertilizer and preparation of the soil shall be done in the direction parallel to the contour lines of the slope (not uphill or downhill).

(3) Method of seeding. - The Contractor shall take advantage of favorable weather and shall employ a method of sowing satisfactory to the Contracting Officer, making use of mechanical hand seeders. Seed shall be sown over the areas topsoiled and fertilized or as otherwise directed by the Contracting Officer. After the seed is sown, the seed shall be put into contact with the soil with a brush harrow, cultipacker, spike-tooth harrow or similar device as directed by the Contracting Officer. Finally the surface shall be firmed with a cultipacker or light roller.

(4) Maintenance. - The Contractor shall maintain the areas sodded or sown to grass seed on each section of the project, until all work on the entire contract has been completed and accepted by the Contracting Officer. This maintenance shall consist of protection against traffic by approved warning signs or barricades, occasional mowing with a scythe or mechanical mower, and removal of all weeds, or any other similar operations whenever required by the Contracting Officer. If any topsoil is washed away or any portions of the seeded areas fail to show a uniform stand of grass, the Contractor shall refertilize and reseed these areas at no additional cost to the Government.

e. Measurement and payment. - Measurement will be made by the square yard for the amount of area fertilized and seeded as directed. The measurement will be of the actual superficial area fertilized and seeded as specified. Payment will be made at the contract unit price for Item 28, "Fertilizing and Seeding".

TP18-3. GRADING (Item 29). - a. Work included. - The Contractor shall perform the required grading, including all borrow and fill, as shown on the drawings, as herein specified, and as directed by the Contracting Officer.

b. Construction methods. - The existing surface shall be excavated or filled to the elevations or slopes indicated on the drawings, or as otherwise directed by the Contracting Officer. Additional fill shall be excavated from borrow areas as directed by the Contracting Officer. All surplus or undesirable excavated material shall be disposed of in the spoil or waste areas as shown on the drawings or directed by the Contracting Officer. The Contractor shall excavate, remove, and

dispose of any material, from the area being graded, which the Contracting Officer considers objectionable in such locations, and refill the area specified.

c. Measurement and payment. - Measurement will be made by the square yard graded as specified or as directed by the Contracting Officer. The measurement will be of the actual superficial area graded as specified. Payment will be made at the contract unit price for Item 29, "Grading".

TP18-b. BITUMINOUS MACADAM PAVEMENT (Item 30). - a. Work included. - The Contractor shall construct the bituminous macadam pavement of the specified quality required for the road and parking area as shown on the drawings and as herein specified.

b. Description. - The pavement shall consist of a one-course wearing surface, 2-1/2 inches compacted thickness, composed of crushed stone bound with keystone and bituminous material and a bituminous seal coat and pea stone covering. The pavement shall be constructed, on a prepared base course, by the penetration method in accordance with these specifications and in conformity with the lines, grades, and typical cross sections shown on the drawings.

c. Base preparation. - The base, having been constructed previously, shall be maintained in acceptable condition during placement of the macadam wearing surface and any damaged areas of the base shall be repaired to the satisfaction of the Contracting Officer.

d. Materials. - (1) Crushed stone shall consist of clean, hard, tough, and durable fragments of rock of uniform quality throughout. The crushed stone shall be free from soft disintegrated pieces, dirt, crusher dust, and organic or other objectionable matter. Coarse aggregate of a size retained on a 1-inch square mesh sieve shall not contain more than 5 per cent of flat or elongated pieces whose length exceeds three times their least dimensions. When tested by means of the Los Angeles Rattler (A.A.S.H.O. T96-38) the crushed stone shall show a loss on abrasion not to exceed 25 per cent at 500 revolutions.

(2) Coarse aggregate shall conform to the following gradation:

Square Mesh Sieve	Total Passing Per Cent by Weight
2-1/2-inch screen	100
2-1/4-inch screen	95 - 100
2-inch screen	70 - 95
1-1/2-inch screen	20 - 50
1-1/4-inch screen	0 - 15
1-inch screen	0 - 5

(3) Key stone used for binding or choking the coarse aggregate shall conform to the following gradation:

Square Mesh Sieve	Total Passing Per Cent by Weight
1-inch screen	100
3/4-inch screen	95 - 100
1/2-inch screen	30 - 70
3/8-inch screen	0 - 20
4 meshes per inch	0 - 5

(4) Pea stone used for sealing the surface of the pavement shall conform to the following gradation:

Square Mesh Sieve	Total Passing Per Cent by Weight
3/4-inch screen	100
1/2-inch screen	95 - 100
3/8-inch screen	30 - 70
4 meshes per inch	0 - 20
8 meshes per inch	0 - 5

(5) Bituminous material. - Bituminous material shall be asphalt cement, conforming to Federal Specification SS-A-706b, of 85 - 100 penetration and applied at temperature of 275 degrees to 350 degrees Fahrenheit.

e. Equipment. - (1) Rollers shall be three-wheeled, self-propelled, smooth-wheeled, weighing not less than ten tons. Rollers shall be equipped with a water spraying device or other approved equipment to prevent bitumen from sticking to the wheels. Rollers shall be in good mechanical condition and shall not drip oil, gasoline, or other foreign substances on the road surface.

(2) Pressure distributors shall be of an approved type, equipped with pneumatic tires, capable of spraying satisfactorily, if required, for a width of not less than fifteen feet at a pressure between forty and sixty pounds per square inch. They shall be equipped with a system for heating the bituminous material that insures the even heating of the entire mass of material under efficient and positive control at all times. Distributors shall also be equipped with satisfactory thermometers for measuring the temperature of the material to be applied and shall have either a steam or air-kerosene system for the clearing of the lines and pumps. Evidence of fluxing with kerosene or emulsification by steam will be sufficient cause for rejection of the delivery. Distributors shall be capable of spreading the bitumen uniformly, shall not leak, and must be in good mechanical condition. The distributors shall also be equipped with accurate tachometers approved by the Contracting Officer. Deliveries of bitumen will be refused when the above conditions are not fulfilled.

(3) Hose attachments to the distributor and slotted spout hand pouring pots shall be used to apply bitumen wherever necessary to touch up all spots unavoidably missed by the distributor.

f. Spreading and compacting coarse aggregate. - (1) On the freshly cleaned and swept base course, coarse aggregate shall be spread in an approved manner to prevent segregation of sizes, forming a uniformly, loose layer to conform with the specified grades and thicknesses when compacted. The aggregate shall then be dry rolled until the stone is thoroughly compacted and keyed together to form a firm even surface true to grade and cross sections given.

(2) The rolling shall begin with the outer edges of the surfaces and shall progress gradually toward the center lapping uniformly each preceding rear wheel track by one-half the width of such track. The rolling shall continue until the entire area of the pavement has been rolled by the rear wheels and become thoroughly keyed, and creeping of stone ahead of the roller is no longer visible. Any portion of the pavement not accessible to rollers shall be thoroughly compacted by mechanical or hand tamping. Hand tampers shall weigh not less than 50 pounds and shall have a face area of not more than 100 square inches.

(3) The compacted coarse aggregate shall then be examined to insure that it possesses a firm even surface, true to the required grades and cross section, and presents a texture which will allow a uniform penetration of the bituminous material. If any irregularities in surface grades or texture appear during or after rolling, such shall be promptly remedied by reconstruction as directed by the Contracting Officer. All coarse aggregate which becomes coated or mixed with dirt or foreign substances prior to penetration with bituminous material shall be removed, replaced with clean aggregate, and re-compacted. Concentrations of fine or undersize aggregate or flat or oversize aggregate appearing on the surface shall be removed and replace.

g. Application of bituminous material. - (1) Hot bituminous material shall be applied uniformly over the surface of the compacted coarse aggregate by approved pressure distributors at the rate of 1-1/2 to 1-3/4 gallons per square yard. The bituminous material shall be applied only when the crushed stone is thoroughly dry, when the weather is not foggy or rainy, and when the air temperature in the shade is 50 degrees Fahrenheit or higher, unless otherwise directed by the Contracting Officer.

(2) The Contractor shall, in order to insure uniformity at the junction of two applications of bituminous material, employ methods acceptable to the Contracting Officer so that penetration is accomplished at the full force of the sprayers on both sides of each junction point. The method used shall eliminate gaps and overlapping between applications. Similar methods or building paper shall be used to prevent overlapping of the bituminous material at longitudinal and other joints. Building paper, if used for this purpose, shall be removed and burned.

(3) The Contractor shall cover the surface of curbs, edgings, walls, walks, or adjacent surfaces satisfactorily to prevent coating them with bituminous material and shall remove any bitumen that may have adhered to the surface in spite of such protective measures.

h. Application of key stone. - Immediately after applying the penetration coat of bituminous material, and while it is still warm, clean, dry key stone shall be spread longitudinally over the surface in such quantity as will completely fill the voids in the coarse aggregate. The key stone shall be spread in an approved manner. The surface shall then be rolled and broomed until the key stone is thoroughly bonded with the bituminous binder and until the surface is well compacted and uniform in appearance.

i. Application of seal coat. - (1) All excess key stone shall be removed and the surface swept clean. A coating of bituminous material at temperature specified (see subparagraph d (5) above) shall then be applied uniformly at the rate of between 1/2 and 3/4 gallon per square yard of surface. After the seal coat has been spread it shall be covered immediately with clean, dry pea stone applied longitudinally in just sufficient quantity to blot up the bituminous material. The entire surface shall then be broomed and rolled as directed by the Contracting Officer.

(2) During the period between the initial compaction of the coarse aggregate and completion of the seal coat, the surface course shall be protected from all traffic other than that absolutely essential to its construction.

j. Part width construction. - When the surface is constructed only for part of the width, the first width of stone shall be spread and rolled not less than 2 feet wider than the bituminous application. The rolling of the adjoining width shall overlap the first and be conducted to leave a smooth and uniform joint. The applications of bituminous material, key stone, and seal coat aggregate at the junction shall be carefully regulated to avoid excess or deficiencies in bituminous material and to create a uniform surface.

k. Surface tolerances. - After completion the surface shall be tested, with a 10-foot straight edge, in both directions. The surface of the finished pavement shall be free from irregularities exceeding 3/8 inch in 10 feet.

l. Measurement and payment. - Measurement will be made by the square yard for the amount of bituminous macadam satisfactorily constructed. Payment will be made at the contract unit price per square yard for Item 30 "Bituminous Macadam Pavement".

TP18-5. TIMBER SHEET PILING (Item 31). - a. Work included. - The Contractor shall install the "Lakefield" type, permanent timber sheet piling, in structure foundations at locations and in accordance with the details as shown on the drawings or as directed by the Contracting Officer.

b. Materials. - The sheet piling shall be of the dimensions shown on the drawings. Timber for any necessary wales and braces shall be of economical dimensions, acceptable in modern practice. All timber used shall be sound and of good quality and shall meet the approval of the Contracting Officer. Nails and other hardware shall conform to current standard practice for the material required and use intended.

c. Installation. - The sheeting shall be driven as true as possible to the lines and grades shown on the drawings, without injury to the piling. Sheeting shall be cut-off, where necessary, to the top elevation, as shown on the drawings or as directed by the Contracting Officer.

d. Measurement and payment. - Measurement will be made by the square foot for the amount of timber sheet piling actually in place as specified below the top elevations shown on the drawings. Payment will be made at the contract unit price for Item 31 "Timber Sheet Piling".

TP18-6. RUBBISH HOIST AND SIDEWALK DOORS (Item 32). - a. Work included. - The Contractor shall install, where shown on the drawings, and in strict accordance with manufacturer's instructions, one electrically-operated telescopic hoist similar and equal to the model D3 as manufactured by the Potts Ash Hoist Corporation. The motor shall be explosion-proof type and shall be capable of operating on 110-volt, single-phase, 60-cycle, A.C. power.

b. Description. - The hoist shall be the truck dumping type, revolving on ball bearings, having a working capacity of 500 pounds with a hoisting speed of 60 feet per minute and designed to lower by gravity. The sidewalk doors shall be standard flush watertight sidewalk doors similar and equal to sidewalk doors as manufactured by the Potts Ash Hoist Corporation. The doors shall be constructed with diamond pattern plate steel leaves reinforced on the under side with angle irons and equipped with heavy bronze hinges with stainless steel hinge pins, channel iron frame and angle condensation gutter, tapped for 3/4-inch drain pipe. A 1-inch drain pipe shall be run from the condensation gutter as shown on the drawings.

c. Painting. - The equipment shall be painted in accordance with the applicable provisions of Section XVII.

d. Payment. - Payment for the hoist, doors and pertinent equipment will be made at the contract price for Item 32 "Rubbish Hoist and Sidewalk Doors".

Bid No.
Serial No. 19-016-47-23

BID
(CONSTRUCTION CONTRACT)

Date:

To: New England Division
Corps of Engineers, War Department
31 St. James Avenue
Boston 16, Mass.

Project: CONSTRUCTION OF KEENEY LANE PUMPING STATION, HARTFORD, CONNECTICUT.

In compliance with your invitation for bids dated 12 February 1947, the undersigned hereby proposes to furnish all plant, labor, materials, and equipment, except materials or equipment specified herein to be furnished by the Government, and perform all work for the above-described project in strict accordance with the specifications, schedules, drawings, and addenda numbered -

for the consideration of the following prices:

Item	Estimated Quantities	Unit	Description	Unit Price	Estimated Amount
1	-	job	Preparation of Site		
2	-	job	Control of Water and Sewage		
3	4,250	cu.yd.	Common Excavation - General		
4	-	job	Removal of Existing Structures and Appurtenances		
5	2,100	cu.yd.	Compacted Backfill		
6	335	cu.yd.	Pit-Run Gravel		
7	810	bbl.	Portland Cement		
8	375	cu.yd.	Concrete		
9	260	cu.yd.	Concrete		
10	88,900	lb.	Steel Reinforcement		
10A	9,000	sq.ft.	Absorptive Form Lining		
11	-	job	Pumping Station Superstructure		

Item	Estimated Quantities	Unit	Description	Unit Price	Estimated Amount
12	16,000	lb.	Miscellaneous Iron and Steel		
13	1,800	lb.	Miscellaneous Pipe and Fittings		
14	2	each	Mechanically Cleaned Bar Screens		
15	-	job	Sluice Gates, Complete with Hoists		
16	-	job	Heating and Ventilating Equipment		
17	-	job	Electric Light and Power System		
18	-	job	Gasoline-Electric Standby Unit		
19	-	job	Traveling Crane		
20	-	job	Water Supply and Plumbing Fixtures		
21	-	job	Carbon Dioxide Fire Extinguishing Equipment		
22	-	job	Sump Pump		
23	-	job	Gasoline Tank and Piping		
24	-	job	Diesel Fuel Tank and Piping		
25	-	job	Float Gage (Recording)		
26	-	job	Installing Equipment Furnished by the Government		
27	40	cu.yd.	Topsoil		
28	240	sq.yd.	Seeding		
29	900	sq.yd.	Grading		
30	390	sq.yd.	Bituminous Macadam Pavement		
31	500	sq.ft.	Timber Sheet Piling		
32	-	job	Rubbish Hoist and Sidewalk Doors		
			TOTAL		

PLANT AND EQUIPMENT SCHEDULE

Available Plant To Be Used

Excavating Equipment

No.	Type	Capacity	Manufacturer	Age & Condition	Location

Concreting Equipment

No.	Type	Capacity	Manufacturer	Age & Condition	Location

Miscellaneous Equipment

No.	Type	Capacity	Manufacturer	Age & Condition	Location

The items of equipment that the bidder proposes to furnish and install in the work, and of which descriptions are required herein, are described on the following data sheets. The bidder agrees that the statements concerning these items made herein are express warranties, and further agrees that the award of this contract shall not be construed as a guarantee by the Government that the materials or supplies listed are approved.

DATA SHEET

MECHANICALLY CLEANED BAR SCREENS

1. Mechanically Cleaned Bar Screens

   a. Manufacturer _____

   b. Model or Type _____

2. Electric motor:

   a. Manufacturer _____

   b. Type and Rating _____

DATA SHEET

SLUICE GATES

1. Gates:

   Manufacturer_____

2. Hoists:

   a. Manufacturer_____

   b. Model or Type_____

   c. Hoisting Speed_____

3. Electric Motors:

   a. Manufacturer_____

   b. Type and Rating _____

DATA SHEET

25 KVA GASOLINE-ELECTRIC GENERATOR UNIT

1. Engine: (Manufacturer)_____

   Number Cylinders_____

   Bore and Stroke_____

   Piston Speed at Rated Output_____

   Lbs. Fuel per kw-hr. at 125% Rated Output of Generator_____

   Lbs. Fuel per kw-hr. at 75% Rated Output of Generator_____

   Battery (Make and Capacity)_____

   Governor (Make and Type)_____

   Net Weights: Engine_____ Pounds

   Generator and Exciter_____ Pounds

   Complete Unit, including Common Base____ Pounds

2. Electric Generator: (Manufacturer)_____

   Rating:_____

   Efficiency, at 80% lagging power factor, as determined in accordance with American Institute of Electrical Engineers standardization rules, will not be less than the following:

   Full load_____%; 3/4 load_____%; 1/2 load_____%

DATA SHEET

TRAVELING CRANE

a. Manufacturer_____

b. Capacity_____Tons

c. Type_____

DATA SHEET

SUMP PUMP

1. Pump:

   a. Manufacturer _____

   b. Model or Type _____

   c. Capacity at 40-foot Head at Rated Speed _____

   d. Shut-off Head _____

   e. Pipe Size of Discharge Connection _____

2. Electric motor:

   a. Manufacturer _____

   b. Type and Rating _____

DATA SHEET

ELECTRIC SWITCHBOARD

Manufacturer_____

Type Construction_____

Overall Dimensions_____

The bidder agrees, upon receipt of written notice of an award of the contract within sixty (60) days after the date of opening of the bids, that he will execute W. D. Contract Form No. 2, in accordance with this bid as accepted, and if the consideration of the contract will exceed $2,000.00 in amount, will furnish to the Government a performance bond on U. S. Standard Form No. 25 or U. S. Standard Form No. 25-B and a payment bond on U. S. Standard Form No. 25-A or U. S. Standard Form No. 25-C with good and sufficient surety or sureties, as required by the specifications, at the time that the contract is executed.

The bidder further agrees that if awarded the contract he will commence the work within fifteen (15) calendar days after the date of receipt by him of notice to proceed, provide the plant and equipment as set forth in the PLANT AND EQUIPMENT SCHEDULE, and that he will fully complete the work ready for use not later than five hundred and twenty-five (525) calendar days after the date of receipt by him of notice to proceed.

Security (bid bond - U. S. Standard Form No. 24) if required by the invitation is inclosed.

_____

By _____

_____
(Title)

_____
(Business Address)

Note: If the bidder is a corporation, indicate State of Incorporation under signature; and if a partnership, give full names of all partners.